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CHEMICAL ABSTRACTS

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1—APPARATUS AND PLANT EQUIPMENT

W. L. BADGER

The form of porcelain evaporating dishes, casseroles and crucibles. WILHELM VOLKMANN. *Chem. Fabrik* 1929, 408-9. J. H. MOORE

Copper flask with standard ground joint. FRITZ FRIEDRICH. *Chem.-Ztg.* 53, 642(1929).—The flask will fit the standard-joint glass app. made by Greiner and Friedrichs. J. H. MOORE

Twin tubes with a membrane filter. IGOR N. ASHESHOV. *Biochem. Z.* 211, 202-6(1929).—An app. is described consisting of 2 communicating tubes so constructed that dialyzing membranes of variable porosity may be inserted between them. Numerous uses for chem. and bacteriol. work are shown where ultrafiltration or dialysis under strictly reproducible conditions is desired. S. MORGULIS

A new fusion calorimeter. H. SACHSE. *Z. physik. Chem., Abt. A*, 143, 94-6 (1929); cf. *C. A.* 23, 5060.—Description of an app. which uses diphenyl ether (m. p. 26.55°), and which is more sensitive than Bunsen's ice calorimeter. J. H. MOORE

A light filter for measurement of color temperature. G. NAESER. *Z. tech. Physik* 10, 160-3(1929).—A simple optical method is used for detn. of color temps. The principle is that for different temps. the intensity ratios of 2 arbitrary lines in the black body spectrum are different. Red and green were selected; a combination of dyes in soln. was used which transmitted mixed monochromatic red and green. Increase in concn. made the absorption of the green line climb more rapidly than that of the red line, consequently the light after passing the red-green filter with an intensity ratio of red and green depending on temp. could be analyzed by a wedge-shaped second filter filled with the same colored soln. The location on the wedge where the light appears in the neutral mixing tint (white) will shift with change in temp.; the wedge can be calibrated directly in degrees. Both filters are combined in one. Details and theory are given; the accuracy is about 13°. B. J. C. VAN DER HORST

Improved calcium chloride tube. D. V. N. HARDY. *J. Chem. Soc.* 1929, 1108.—A U-tube in which the stopper of one arm is made to serve as a water trap combines the advantages of the 2 chief types of drying tubes in common usage. J. W. S.

New apparatus for rapid and accurate determination of specific gravity of liquids. MIECZYSLAW GROCHOWSKI. *Przemysl Chem.* 13, 387-90(1929).—This is a differential type of app. It can be so arranged that only one reading is required. A. C. Z.

A glass electrode apparatus for measuring the p_H values of very small volumes of solution. D. A. MACINNES AND MALCOLM DOLE. *J. Gen. Physiol.* 12, 805-11(1929); cf. *C. A.* 23, 2327.—A glass electrode app. is described with which the p_H of as little as 0.14 cc. of soln. may be measured. It has been used successfully to study the change in p_H of the sap of *Nitella* due to the penetration of brilliant cresyl blue. Under the same condition the usual H electrodes are poisoned. C. H. RICHARDSON

A recording apparatus for determination of the magnetic transition points of small samples. E. LEHRER. *Z. tech. Physik* 10, 177-85(1929).—A small sample in a quartz bulb is suspended in a nonhomogeneous field (wedge-shaped interpolar space), the ponderomotive force being recorded by a system of levers and mirror to give the ordinate of the graph. The abscissa motion of the recording light beam is brought about by a mirror on the galvanometer of the thermoclement which measures the temp. of the sample. The substance can be heated by a small elec. oven, externally cooled by water. The theory and possibilities of the instrument are discussed at some length. Curves are shown for Fe at various field strengths. Of the unusual applications are cited: quant. analysis of an iron-cementite mixt. (3% accurate), thermal decompn. of Fe_3N into Fe_2N . Preliminary data on the latter process are given. B. J. C. v. H.

Micropolarization tubes with mat walls. H. NAUMANN. *Biochem. Z.* 211, 239-43 (1929).—Errors produced by reflection from the walls of the tube in polarization with

tubes of small diam. are best avoided by using tubes of black glass etched on the inside with HF. Prepn. of these tubes is discussed. S. MORGULIS

The modern high-power centrifuge. A. BERGERHOFF. *Chem.-Tech. Rundschau* 44, 891(1929).—Improvements in discharging app. for centrifuges are discussed. E. PICKERING

Recent data on the "ter Meer" automatic centrifugal. GUSTAV TER MEER. *Chem. Fabrik* 1928, 557-9.—Output, time and power requirements are given for the solid basket type of 900 and 1100 mm. diam., and for the sieve type of 1100 and 1800 mm. diam. J. H. MOORE

Drives for Weston centrifugals. S. HOPFERWIESER. *Brown Boveri Rev.* (Baden) 16, No. 9, 254-9(1929).—Description of centrifugal with shaft of basket suspended from flexible vertical bearing of type principally used in sugar factories and refineries; also used in textile mills and chem. plants. E. I. S.

The present situation of the manufacture of centrifugal pumps. C. PFLEIDERER. *Z. Ver. deut. Ing.* 73, 177-87(1929).—An illustrated article describing the various pumps now being mfd. with illustrations describing their appearance. M. C. ROGERS

An osmometer for measuring the osmotic pressure of colloids. A. GRIELOT AND A. BOUTROUX. *J. chim. phys.* 26, 224-8(1929).—The osmometer consists of 2 hemispheres to which are attached capillary tubes and which may be joined together with a semi-permeable membrane between. Half of the instrument is filled with a hydrosol and the other half with its ultra-filtrate. The initial location of the meniscus of the hydrosol in the capillary is observed. The pressure necessary to move the meniscus back to its original position is a measure of the osmotic pressure. The technic required to use the app. is described. L. L. QUILL

Apparatus for electro-analysis. M. L. NICHOLS. *J. Chem. Education* 6, 1551-4(1929).—An illustrated description of six-unit app. for electro-analysis used at Cornell Univ. for about 5 yrs. W. C. EBAUGH

Gas holders of constant volume and variable pressure. J. H. BRUNKLAUS. *Het Gas* 49, 277-81(1929).—The use of const.-vol. gas holders (Horton spheres) is discussed. For low-pressure distribution the compression cost of the gas can be reduced about 50% by utilization of the high storage pressure of the gas in a compressed gas motor-elec. generator set. B. J. C. VAN DER HOEVEN

Industrial measurements. I. Weighing. EVERETT P. PARTRIDGE. *Ind. Eng. Chem.* 21, 740-4(1929).—A description is given of modern automatic weighing machines equipped with integrating and recording mechanism. L. A. PRIDGEON

Improved method of installing carbon dioxide meters. ANON. *Power* 70, 24(1929).—Illustrated description of a device for continuous gas sampling developed by the Brown Instrument Co., Philadelphia. D. B. DILL

A continuous gas sampler. PAUL SPEER. *Power* 70, 455(1929); cf. preceding abstr.—Another type of continuous gas sampler is described. The rate of discharge of water is const., thus giving a more representative sample of gas. D. B. DILL

A simple method for maintaining the pressure constant in a gasometer. GEORG SCHULTZE. *Chem. Fabrik* 1928, 703.—Description of a simple device to compensate the loss of weight when the bell of the gasometer sinks. ALBERT L. HENNE

A high-pressure, gas-compression system. J. R. PILLEY AND W. L. EDWARDS. U. S. Dept. Agr., *Circ.* 61, 1-18(1929).—The operation of a system for exptl. work with gases at normal temp. and at pressures up to 1500 atm. is described. Detailed drawings of each piece of equipment are shown, permitting the complete construction of the system described. Descriptions of the app., together with approx. costs of its various parts, are included. W. H. ROSS

A demonstration apparatus for the Maxwell distribution law. F. A. SCHULZE. *Physik. Z.* 30, 325-7(1929). F. R. BICHOWSKY

Measurements of surface tension in the laboratory and in the plant (CASSEL) 2.

Apparatus for carrying out physical and chemical reactions. ADOLF KÄMPF. *Ger.* 481,744, Jan. 4, 1927. App. for carrying out phys. and chem. reactions particularly between gases or vapors and liquids or pastes comprises a rotary horizontal or inclined cylinder contg. the liquid or paste with orifices for the passage of the gas or vapor.

Mixing apparatus suitable for effecting chemical reactions. GASTON S. P. DE BETHUNE. U. S. 1,727,753, Sept. 10.

Apparatus for removal of dust from gases by mechanical deposition and washing. RENAUD DIENNE. *Fr.* 658,853, Aug. 9, 1928.

- Colorimeter.** WILL C. NEHR (to Gardner-Denver Co.). U. S. 1,728,358, Sept. 17. Structural and optical features are described, of an app. suitable for use in testing steel.
- Thermometer.** THOMAS M. STEWART (to Taylor Instrument Companies). U. S. 1,729,208, Sept. 24. Structural features.
- Thermometer.** KENNETH L. TATE (to Taylor Instrument Companies). U. S. 1,729,209, Sept. 24. Structural features.
- Bimetallic thermometer.** WM. M. CHACE (to W. M. Chace Valve Co.). U. S. 1,729,245, Sept. 24. Two elements are welded together, one of which comprises C 0.35, Si 2.00, Ni 40 and Fe 57.65%; the other comprises C 0.25, Si 1.75, Cr 13.25, Ni 2.5, Cu 5.0 and wrought iron 77.25%.
- Pyrometer.** ROBERT C. PAIRMAN. U. S. 1,728,626, Sept. 17.
- Turbidometer for detecting smoke in air, etc.** H. C. GRANT (to W. Kidde & Co.). Brit. 306,825, Feb. 25, 1928.
- Viscometer.** CARL D. MILLER. U. S. 1,727,836, Sept. 10. Structural features of an app. having two concentric members between which the material tested flows and which are relatively movable.
- Viscometer (with gravity flow through a fine orifice).** C. W. B. SHORTO. Brit. 307,602, Feb. 13, 1928. Structural features.
- Calibrating weights.** WALTER O. SNEILING. U. S. 1,726,931, Sept. 3. Calibration is effected by adding a plurality of measured lengths of wire of different diams. of known wt. per unit of length.
- Cloths for filter presses.** CORNELIS H. CAALS. Ger. 481,903, Oct. 20, 1926.
- Rotary vacuum filter.** ALFRED SCHOLZ. Ger. 481,983, Oct. 31, 1924. Details.
- Air filter (with corrugated plates wetted with oil).** H. AUSTIN. Brit. 307,540, Dec. 10, 1927. Structural features.
- Air and oil filter.** HAROLD W. SLAUSON. U. S. 1,729,135, Sept. 24. Structural features.
- Oil filter.** ESTEL C. RANEY. U. S. 1,728,305, Sept. 17. Structural features.
- Apparatus for purifying and filtering liquids.** OSKAR KARY. Fr. 659,598, Aug. 28, 1928.
- Single-stage rotary filter or strainer for liquids.** FRANCIS W. BRACKETT. U. S. 1,726,008, Sept. 3. Structural features.
- Siphon-feed device for filtering liquids.** RAYMOND B. MILLARD. U. S. 1,727,554, Sept. 10. Structural features.
- Water filter with means for washing the filtering mass.** RAPPRESENTANZE INDUSTRIALI S. A. Fr. 659,626, Aug. 29, 1928.
- Filter press.** M. WILDERMAN. Brit. 307,525, Nov. 10, 1927.
- Filter presses.** SOC. ANON. DES ÉTABLISSEMENTS ROUCHAUD ET LAMASSIAUDÉ. Fr. 659,691, Dec. 21, 1927. Constructional details.
- Filter-bag support.** HARRY B. WATERS. U. S. 1,728,381, Sept. 17. Structural features.
- Apparatus for separating oil from steam by baffling and gravity.** HATSUNOSUKE YAMAMOTO. U. S. 1,726,688, Sept. 3. Structural features.
- Apparatus for separating oil and gas.** SMITH L. STOVALL (to C. A. Gibson and J. F. Gibson, Jr.). U. S. 1,727,733, Sept. 10. Structural features.
- Apparatus for separating oil from compressed air, etc.** FREINS J. MONNERET. Brit. 306,899, Feb. 27, 1928. Structural features.
- Condenser suitable for use in oil distillation.** PHILANDER R. GRAY (to Gray Processes Corp.). U. S. 1,728,284, Sept. 17. Structural features.
- Apparatus for removing suspended particles from gases by baffling and filtration.** R. S. POTHAM and TANGENTIAL DRYERS, LTD. Brit. 306,697, Feb. 15, 1928. An app. is described, for use in a modification of the process described in Brit. 271,545 (C. A. 22, 1502).
- Apparatus for gravity separation of solid particles from gases.** ALBERT R. MUMFORD (to New York Steam Corp.). U. S. 1,728,877, Sept. 17. Structural features.
- Apparatus for separating dust from gas currents by centrifugal action.** A. STEVENART. Brit. 307,334, March 5, 1928. Structural features.
- Apparatus and system for separating gases such as constituents of air or natural gas by liquefaction.** RICHARD C. TOLMAN, WILLIAM L. DE BAUFRE, JOHN W. DAVIS and MONTAGUE H. ROBERTS (to Samuel G. Allen, trustee). U. S. 1,728,947, Sept. 24. A process is described suitable for sepn. of He.
- Apparatus for separation of gases by liquefaction.** SOC. L'AIR LIQUIDE (SOC. ANON. POUR L'ÉTUDE ET L'EXPLOITATION DES PROCÉDÉS GEORGES CLAUDE). Fr. 659,890, Dec. 23, 1927.

Gas-analysis apparatus. WILLIAM KEMP. U. S. 1,727,544, Sept. 10. Structural features, suitable for detg. CO_2 in flue gases.

Diffusion apparatus for detecting the presence of gases in the atmosphere. BRUNO TREBITSCH. Fr. 658,379, July 27, 1928.

Gas holder with flexible fabric sides carried on guide rollers. WATERLESS GAS-HOLDER CO., LTD., and A. GADD. Brit. 306,716, March 3, 1928.

Gas-purifying apparatus utilizing liquid sprays. CHARLES G. HAWLEY (to Centrifix Corp.). U. S. 1,726,828, Sept. 3. Structural features.

Gas-washing column apparatus with rotating liquid spraying plates. F. H. WAGNER (to Bartlett Hayward Co.). Brit. 307,453, March 8, 1928. Structural features are described. Ferrous or Al sulfates may be used as flocculating agents, preferably with CaCO_3 or Na_2CO_3 .

Clock-work control for gas supplied to burners, etc. METROPOLITAN GAS METERS, LTD., and J. D. FORSTER. Brit. 307,176, Feb. 3, 1928.

Apparatus for maintaining a proportioned flow of gases such as air and nitrogen [for combustion to obtain nitrogen]. WALLACE B. VAN ARSDEL (to Brown Co.). U. S. 1,727,418, Sept. 10. Suitable lengths of piping are used as resistances to regulate the flow of different gases. Various structural features are described.

Apparatus for supplying compressed gas from vessels containing liquefied gas. GES. FÜR INDUSTRIEGASVERWERTUNG. Brit. 307,083, Jan. 14, 1927. Structural features.

Apparatus for the distribution of gases under pressure by means of liquefied gas. SOC. L'AIR LIQUIDE (SOC. ANON. POUR L'ÉTUDE ET L'EXPLOITATION DES PROCÉDÉS GEORGES CLAUDE). Fr. 659,674, Dec. 20, 1927.

Container for rapid dispensing of compressed or liquefied gas such as carbon dioxide. R. M. L. LEMOINE. Brit. 307,501, March 10, 1928. Structural features.

Apparatus for liquefying and rectifying gaseous mixtures. GESELLSCHAFT FÜR LINDE'S EISMASCHINEN A.-G. Fr. 658,477, Aug. 1, 1928.

Apparatus for obtaining solutions of gases. ISAAC LÉVY. Fr. 658,490, Aug. 2, 1928.

Apparatus for bringing liquids into intimate contact with gases. W. C. HOLMES & CO., LTD. Fr. 659,295, July 26, 1927.

X-ray apparatus. EDWIN S. HUMPHREYS (to Aurora X-Ray Mfg. Co.). U. S. 1,727,883, Sept. 10. Structural features.

Röntgen-ray apparatus. A. F. PIERER. Brit. 307,143, Dec. 23, 1927. Structural features.

Röntgen-ray apparatus. N.-V. PHILIPS' GLOEILAMPENFABRIEKEN. Brit. 307,377, Dec. 5, 1927. Structural features.

Photoelectric cell. V. K. ZWORYKIN (to Associated Electrical Industries, Ltd.). Brit. 307,082, March 3, 1928. A layer of a conductor such as Mg, an alk. earth metal or alloy, Al alloy or misch metal is deposited upon a surface within the cell and subsequently there is vaporized a substance such as an alkali metal compd. which will form a thin film on the cond. layer. Various details of structure and procedure are described.

Electron tubes. SIEGMUND LOEWE and EDGAR RÖHMILD. Fr. 659,799, Aug. 31, 1928.

Electron discharge tubes. COMPAGNIE FRANÇAISE POUR L'EXPLOITATION DES PROCÉDÉS THOMSON-HOUSTON. Fr. 659,294, Aug. 17, 1928.

Electron discharge tubes. N.-V. PHILIPS' GLOEILAMPENFABRIEKEN. Fr. 658,800, Aug. 10, 1928.

Electric vacuum tubes. S. RUBEN (to Arcturus Radio Tube Co.). Brit. 306,832, Feb. 25, 1928. Heating filaments of indirectly heated cathodes are insulated by forming a coating of oxide on the wire used (preferably Ta) and covering the oxide with a layer of material (preferably SiO_2) of greater dielec. strength than the oxide coating and capable of combining with the latter. Various details are given.

Thermionic vacuum tubes. B. LOEWE. Brit. 306,960, Feb. 28, 1928. Cathodes are coated with highly emissive metals such as Ba, Ca or Sr or their compds. by a chem. reaction which effects vaporization and deposition of the metal within the tube; e. g., powdered Si and BaO in tablet form together are introduced into the tube prior to exhaustion and suitably heated.

Thermionic valves. B. LOEWE. Brit. 307,028, March 1, 1928. Electron-emitting substances such as Ba or Sr are deposited on cathodes by enclosing the metal (or substances from which it is evolved) in a metal capsule which is attached to the anode and subsequently heated (suitably by eddy currents). Various structural details and details of procedure are described.

Thermionic valves. E. Y. ROBINSON and METROPOLITAN-VICKERS ELECTRICAL Co., LTD. Brit. 307,099, Dec. 1, 1927. Electron-emitting cathodes are made before insertion into a vacuum tube by assocg. a core of Ni, Pt, etc., with an alk. earth metal or amalgam or compd. which when heated will deposit the metal and heating *in vacuo* or in an inert or reducing atm. to effect impregnation of the core with the alk. earth metal. The impregnated filament is mounted in a vacuum tube and is activated by heat in the presence of Mg, Ba or misch metal vapor. Various details of procedure are described.

Thermionic valves. GRAHAM AMPLION, LTD., and P. FREEDMAN. Brit. 307,325, Dec. 5, 1927. The cathode is heated by the dielec. losses of a condenser having a refractory dielec. such as zirconia, thoria or silica assocd. with Ni and supplied with a. c. Various structural features are described.

Thermionic valves. GRAHAM AMPLION, LTD., and P. FREEDMAN. Brit. 307,326, Dec. 5, 1927. Various structural details are described of a valve which may be highly exhausted and may be provided with a filament or other heater coated with a material capable of emitting pos. ions such as a compn. prepd. by fusion of a mixt. of magnetite with 1% of Al_2O_3 and 0.5% of $CsNO_3$; or the valve may contain gas at low pressure such as He or Ne or the vapor of an alkali metal such as Cs or Rb. An auxiliary W rod electrode may be employed. Brit. 307,327 also described structural features of valves having an indirectly heated cathode. The space between the cathode and the heater may be vacuuous or may be filled with a refractory insulating material, as silica or zirconia, which is a conductor of heat at the temp. used. The cathode has an outer envelope coated with electron-emitting material and is formed in part of refractory metal such as Pt or W with an adhering layer of ferro-magnetic material such as soft iron.

Three-electrode thermionic valves. ERNEST E. CHARLTON (to General Elec. Co.). U. S. 1,728,822, Sept. 17. In operating a 3-electrode thermionic device contg. an alkali metal and having a thoriated W cathode, the pressure of the vapor of the alkali metal in the space surrounding the cathode is controlled to maintain it at a value below that at which appreciable ionization by collision will occur, and an emission of pos. ions from the cathode is produced and the grid of the device is maintained at sufficient neg. potential with respect to the cathode to collect the pos. ions emitted and thus produce an efficient detector action of high-frequency signals.

Thermionic (four electrode) valves. GRAHAM AMPLION, LTD., and P. FREEDMAN. Brit. 307,378, Dec. 5, 1927. Various structural details are described. The cathode may consist of a sheet or wire of W, Mo, Pt or Ni and may be coated with alk. earth oxides. The space between the heater and cathode may be filled with zirconia or silica, or may be vacuuous.

Furnaces. LEVI SNYDER LONGENECKER. Ger. 481,676, June 30, 1926. Details of the construction of the fire chamber.

Furnaces. AMERICAN ENGINEERING Co. Fr. 659,520, Aug. 24, 1928. Construction of walls is described.

Shaft furnace for treating solids with gases. AKTIESELSKAPET NORSK STAAL (ELEKTRISK-GAS-REDUKTION). Fr. 659,200, Aug. 21, 1928.

Annealing furnace. AKTIEN-GESELLSCHAFT BROWN BOVERI & CIE. Ger. 482,001, Mar. 18, 1927. Details of the cooling chamber.

Coal-dust furnace. ERNST JÜRGENS. Ger. 481,940, Mar. 18, 1926. Details are given.

Burners for powdered fuel. CLARKE, CHAPMAN AND Co., LTD., and WM. A. WOODSON. Fr. 659,497, Aug. 24, 1928.

Burners for powdered fuel. INTERNATIONAL COMBUSTION ENGINEERING CORP. Fr. 659,765, Aug. 30, 1928.

Burners for liquid fuels. WILLIAMS OIL-O-MATIC HEATING CORP. Fr. 659,162, Aug. 20, 1928.

Gas furnace. RICHARD ZEH. Ger. 482,010, Oct. 5, 1928. A method of mixing the compressed gas is described.

Gas burner. CARL A. BROWN and ANDREAS C. NIELSEN (to General Electric Co.). U. S. 1,729,149, Sept. 24.

Gas burner. J. KEITH & BLACKMAN Co., LTD., and G. KEITH. Brit. 306,646, Dec. 15, 1927.

Tubular gas burner. RICHARD THURM (to Baker Perkins Co.). U. S. 1,727,527, Sept. 10.

Rotary kiln. MASCHINENBAU-ANSTALT HUMBOLDT. Ger. 481,655, Apr. 30, 1926. Details of the firing nozzles.

- Continuous tunnel kiln (of the muffle type).** H. M. ROBERTSON. Brit. 306,813, Feb. 25, 1928.
- Heat-exchange apparatus with zig-zag channels.** R. SELIGMAN. Brit. 307,425, March 7, 1928. Structural features.
- Heat-exchange apparatus for vapor and liquid.** HUGO BERGQUIST and PAUL T. KUEBLER (to Elliott Co.). U. S. 1,726,943, Sept. 3. Structural features.
- Tubular heat-exchange apparatus.** SCHMIDT'SCHE HEISSDAMPF-GES. Brit. 307,068, March 3, 1928. Structural features.
- Tubular heat-exchange apparatus suitable for vapor and liquid.** EVERETT N. SIEDER (to Foster Wheeler Corp.). U. S. 1,726,995, Sept. 3. Structural features.
- Cooling furnaces by spraying with atomized water.** VESUVIUS FEUERUNGSBAU G. M. B. H. Ger. 481,673, Aug. 27, 1927.
- Apparatus for indicating combustion conditions in furnaces.** MATTHEW ERNST and HARRY B. HOLTHAUS. U. S. 1,728,929, Sept. 24.
- Acetylene generator suitable for supplying an engine or blow pipe.** C. DE LA ROCLETTE. Brit. 307,401, March 6, 1928. Structural features.
- Carbide agitator for acetylene generators.** HERBERT G. IRWIN. U. S. 1,727,981, Sept. 10. Structural features.
- Apparatus for compressing acetylene.** JOSEF MACHTOLF (to Chr. Hostmann-Steinberg'sche Farbenfabriken G. m. b. H.). U. S. 1,729,430, Sept. 24. Structural features.
- Condenser for use in distilling water, oils, alcohol, acids or other materials.** VINCENT R. ROSTEK. U. S. 1,727,179, Sept. 3. Structural features.
- Device for automatic feeding of boiler compounds.** ROBERT R. SMILEY (to Sealax Laboratories, Inc.). U. S. 1,728,513, Sept. 17. Structural features.
- Multi-stage mixing or emulsifying apparatus of the turbine or centrifugal pump type.** KURT WINKLER (to I. G. Farbenind. A.-G.). U. S. 1,727,152, Sept. 3.
- Mill, with grinding disks, for homogenizing, emulsifying and similar operations.** WM. EPPENBACH. U. S. 1,728,178, Sept. 17. Structural features.
- Roller mill for grinding paints or other materials.** A. E. G. MACCALLUM. Brit. 307,312-13, Sept. 5, 1927. Structural features.
- Air-moistening apparatus with automatically controlled electric heater.** CHARLES H. COCHRANE. U. S. 1,727,009, Sept. 3.
- Water-cooled mold for centrifugal casting apparatus.** HILAND R. FARNSWORTH (to Paper & Textile Machinery Co.). U. S. 1,726,698, Sept. 3. Structural features.
- Jacketed autoclave and stirrer for treating materials with gases.** SCHERING-KAHLBAUM A.-G. and W. BAENSCH. Brit. 307,581, Jan. 18, 1928.
- Sheet metal funnel with a hollow seam serving as vent tube.** KERMIT F. BLACK. U. S. 1,727,195, Sept. 3. Various structural features are described.
- Explosion vent system for gas distribution pipes.** JAMES L. ANDERSON (to Air Reduction Co.). U. S. 1,726,940, Sept. 3.
- Apparatus for generating steam and vermicidal vapor for discharge through a nozzle.** WILHELM LECHLER. U. S. 1,727,995, Sept. 10. An app. is described suitable for disinfecting and destroying vermin in buildings, furniture, etc.
- Closed container for volatile liquids.** CLAYTON L. DAY (to Chicago Bridge & Iron Co.). U. S. 1,729,156, Sept. 24. Structural features.
- Heat-insulated annealing covers.** J. THOMPSON (Wolverhampton), LTD., A. JEAVONS and J. W. ANSLAW. Brit. 307,605, Feb. 17, 1928. Structural features.
- Apparatus (with a rotating pan) for separating magnetic from non-magnetic materials by magnetic and centrifugal action.** JOHN JOHNSTON. U. S. 1,727,543, Sept. 10. Structural features.
- Apparatus (with a conical tank and vertical screw device) for mixing grain or other materials.** OLIVER O. HOWARD. U. S. 1,728,411, Sept. 17. Structural features.
- Apparatus for dewatering flaked agar or similar materials.** JOHN BECKER (to American Agar Co.). U. S. 1,726,912, Sept. 3. Structural features.
- Tank and circulating system for separating glue pellets or other solids from liquids.** JESSE R. POWELL (to Armour & Co. of Ill.). U. S. 1,729,547, Sept. 24. Structural features.
- Apparatus for purifying air by injection of steam sprays.** EDMUND MAGERLE (to the firm of Wengraf & Platzer). U. S. 1,728,425, Sept. 17. Structural features.
- Device for cleaning the cathode mercury in large rectifiers.** WALTER NUHLS (to Westinghouse Elec. & Mfg. Co.). U. S. 1,729,450, Sept. 24. Structural features.
- Lining for sewer or other pipes of metal, concrete, etc.** J. A. GREENE and BIND-PLAST PRODUCTS, LTD. Brit. 306,756, April 18, 1928. An anti-corrosive lining is

formed of sand admixed with 15-20% of a soln. contg. equal parts of MgO and MgCl₂ and which also may contain about 5% of alum. The surface of the lining may be treated with a celluloid or enamel coating.

Electric temperature-indicating system. DELOS M. PALMER (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,803, Sept. 17. Structural features.

Thermostatic and electric control system for electrically heated apparatus. EDWARD B. NEWILL (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,802, Sept. 17. Structural features.

Thermostatic control for heating systems. WARREN WEBSTER & Co. Brit. 307,376, Dec. 5, 1927. Electrical and mechanical features are described.

Thermostatic electric switch. P. A. KLINGE and O. E. BORGSTROM. Brit. 307,252, May 21, 1928. Structural features.

Thermostatic electric switch. R. MACLAREN. Brit. 307,135, Dec. 21, 1927. Structural features.

Thermostatic electric switch. IRVIN G. THOMAS (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,811, Sept. 17. Structural features.

Thermostatic control for electric circuits. HOWARD D. MATTHEWS (to Westinghouse Elec. & Mfg. Co.). U. S. 1,726,718, Sept. 3. Structural features.

Thermostat for control of electric circuits. JOHN J. SIMMONS and RALPH J. DELANEY (one third to J. N. M. Shimer). U. S. 1,728,012, Sept. 10. Structural features.

Thermostatic valve. J. KEITH & BLACKMAN CO., LTD., and G. KEITH. Brit. 306,735, March 21, 1928.

Thermostatic device for controlling gas burners of water heaters, etc. PAUL H. HAMILTON (to Sands Mfg. Co.). U. S. 1,726,954, Sept. 3. Structural features.

2- GENERAL AND PHYSICAL CHEMISTRY

FREDERICK L. BROWNE

- Dr. Carl Auer von Welsbach.** O. KREH. *Elektrotech. Maschinenbau* (Lichttechnik) 6, 120(1929). Obituary. C. G. F.
- Eugène Aweng, 1859 1929.** GABRIEL HUMBERT. *J. pharm. Alsace Lorraine* 56, 188-92(1929). Obituary, with portrait and a list of his publications. S. W.
- Sir Humphry Davy, 1778 1829.** E. A. LUM. *Pharm. J.* 122, 522(1929).—Descriptive of Davy's discoveries and personality. S. WALDBOTT
- A. F. Holleman.** J. P. WIBAUT. *Chem. Weekblad* 26, 141-4(1929).—An address in honor of Holleman's 70th birthday. E. C. M.
- Léon Lindet.** P. N. *Ann. fals.* 22, 388-91(1929).—An obituary. A. P. C.
- Charles F. McKenna.** RICHARD K. MEADE. *Ind. Eng. Chem.* 21, 987-8(1929).—A biographical sketch with portrait. E. C. M.
- Wilhelm Pfeffer.** FRANK M. ANDREWS. *Plant Physiology* 4, 285-8(1929).—A biographical sketch accompanied by a full-page photograph of Pfeffer. W. T.
- Eduard Pflüger's birthday centennial.** LEON ASHER. *Naturwissenschaften* 17, 555-7(1929). B. J. C. VAN DER HOEVEN
- Charles Roszak (1882 1929).** LÉON GUILLET. *Rev. métal.* 26, 451-4(1929).—An obituary with portrait. A. PAPINEAU-COUTURE
- Prof. Dr. L. H. Siertsema.** M. DE HAAS. *Physica* 9, 257-62(1929).—Biography with portrait. B. J. C. VAN DER HOEVEN
- Charles Mayer Wetherill, 1825 1871.** Part IV. EDGAR F. SMITH. *J. Chem. Education* 6, 1668-80(1929); cf. C. A. 23, 4602. E. J. C.
- Priestley Medal award [to Francis P. Garvan].** *Ind. Eng. Chem.* 21, 896-8(1929). Address of presentation. IRVING LANGMUIR. Pp. 896-7. Acceptance for Mr. Garvan. W. W. BUFFUM. P. 897. Address by Julius Stieglitz. P. 897. Random thoughts of a lay chemist. FRANCIS P. GARVAN. P. 898. E. C. M.
- The synthetic chemistry of the future.** J. F. THORPE. *Chem. Age* (London) 21, 35-6(1929). E. J. C.
- A possible source of error in rapid weighing.** M. B. GEIGER. *J. Chem. Education* 6, 1629(1929).—Static electricity has accounted for appreciable errors. E. J. C.
- Rational nomenclature of chemical compounds.** A. SEMENTZOV. *Ukrainskii Khim. Zhurnal* 3, No. 1, Sci. Pt. 39-45(1928). JAROSLAV KUCERA
- Modern concepts in physics and their relation to chemistry.** IRVING LANGMUIR. *J. Am. Chem. Soc.* 51, 2847-68(1929); portrait. —President's address, Am. Chem. Soc. Following a briefer statement of the milestones in the development of physics the modern concepts ushered in by the quantum theory and in particular by the rela-

tivity theory are discussed in such a way as to emphasize to the chemist the importance of keeping up-to-date in his viewpoints with a knowledge of modern physics recognized as essential. Physics and chemistry are being inevitably drawn closer together; neither can afford to neglect the other. It is pointed out how the progress of science depends largely upon (1) giving to words meanings as precise as possible, (2) definition of concepts in terms of operations and (3) development of models (math. as well as mech.) which have properties analogous to those of observed phenomena. Scientists have been guilty of devoting much effort to attempts to answer meaningless questions. The significance of the Bohr-Heisenberg uncertainty principle is emphasized. The at. theory and the quantum theory may now be looked upon as representing reality to a higher degree than almost any other of our phys. and chem. theories. The original conception of the relation between cause and effect which was universally accepted in science has lost its meaning. In estg. the reliability of scientific knowledge it should be kept in mind that "the whole complexion of a science may be made to change by the psychology of the investigators which governs the choice of the subjects that are investigated." Revolutionary changes in chemistry are coming. E. J. C.

The results of certain experiments in the teaching of chemistry to college students. VICTOR H. NOLL. *J. Chem. Education* 6, 1740-7(1929). E. J. C.

Freshman chemistry in America in 1822. MARTIN J. McHENRY. *J. Chem. Education* 6, 1644-58(1929). E. J. C.

An experiment to illustrate the law of multiple proportions. JOHN C. BAILAR, JR. *J. Chem. Education* 6, 1759-60(1929). E. J. C.

A Persian translation of the eleventh century Arabic alchemical treatise 'ain as-san'ah wa 'aun as-sana'ah. MAQBUL AHMAD AND B. B. DATTA. *Mem. Asiatic Soc. Bengal* 8, 419-60(1929). E. J. C.

The present status of the Nernst heat theory. SCHMOLKE. *Z. ges. Naturf. Ind* 36, 154-8(1929). F. D. ROSSINI

Chemical structure. TIBOR ERDEY-GRUZ. *Magyar Chem. Folyóirat* 35, 66-77, 81-9(1929).—Summary of the modern theory of atomic structure and homopolar compounds. S. S. DE FINÁLY

Nomography. OTTO LIESCHE. *Chem. Fabrik* 1929, 373.—Nomogram for pycnometer correction. Cf. *C. A.* 23, 3381, 3382. J. H. MOORE

Apparatus and methods for preparing very clean mercury. DUANE ROLLER. *J. Optical Soc. Am.* 18, 357-9(1929).—An outline of the technic for cleaning Hg for photoelec. purposes. The highest obtainable purity is a most essential requirement in the investigation of the photoelec. properties of a substance. F. V. J., JR.

A new method for measuring small pressures with a distant indicator. A. SIMON AND F. FEHER. *Z. Elektrochem.* 35, 162-5(1929). This method has been devised to measure the vapor tension of substances which are apt to explode and damage the pressure indicator. It is based on the displacement of a Hg column in the narrow clearance between 2 concentric, nearly horizontal glass tubes. A tin foil is wrapped around the outside glass tube, so that the combination of the tin and Hg surfaces sepdl. by the glass constitutes an elec. condenser, whose capacity varies with the displacement of the Hg. This capacity is then inserted in a radio receiving circuit. The adjustment of a variable condenser in an emitting circuit required to keep both circuits in tune measures the pressure displacing the Hg after the app. has been calibrated. ALBERT L. HENNE

Heat conduction problems. E. GRIFFITHS. *Proc. Phys. Soc. (London)* 41, 151-79(1929); cf. *C. A.* 23, 2264.—For the purpose of thermal cond. measurements, materials may be divided into 4 classes: (1) those of low thermal cond., such as cold-storage insulators; (2) those in the form of thin sheets, and those employed in building construction; (3) refractories and materials employed in furnace construction; (4) pure metals and alloys. In testing materials of low thermal cond. (haked slab cork can be obtained with $K = 0.00007$ c. g. s. unit) attention has to be given to heat leakage from corners and edges if the hot-plate method is used. The simplest procedure is to eliminate the effect by the use of a guard-plate. Substances in the form of thin disks can be tested by the divided bar method, the correction for the thermal resistivity of the two Hg films being obtained by independent expts. using a thin disk of iron instead of the specimen. For the study of refractories a furnace is made up of "silit" rod heaters which can raise one face of the slab under test to any temp. up to 1000°. On the top of the slab is a water-flow calorimeter fitted with a guard-ring. For the study of metals and alloys the guard-tube method is recommended. The space between the guard-tube and specimen is packed with a powder of low thermal cond. In

two groups of alloys, Al alloys and bronzes, the values of the Lorentz coeff. approx. to the values for the pure metals which form the principal constituents of the alloys.

B. C. A.

Logarithmic mixture law. J. DEJMEK. *Physik. Z.* **29**, 907-8(1928).—The relation between the simple and the logarithmic mixt. laws is discussed. The latter is applicable to the calcn. of elec. and thermal conductivities for alloys of the Cd-Bi, Al-Bi and Ag-Pd types, and also to the calcn. of the viscosity of liquid mixts.

B. C. A.

Parachor and chemical constitution. XI. Arsenic and selenium compounds. W. J. R. HENLEY AND SAMUEL SUGDEN. *J. Chem. Soc.* **1929**, 1058-65; cf. *C. A.* **22**, 2153.—The at. parachor for Se calcd. from 5 compds. gave a mean value of 62.5 and for As from 4 compds. a value of 50.3. These const., together with those detd. in earlier papers of this series, show a regular variation of at. parachor with at. no. The phys. const. for a no. of As and Se compds. were detd. and the parachors calcd. Detns. of the mol. wt. of SeOCl_2 in C_6H_6 by the f.-p. method indicated that this compd. must be highly assocd.

J. W. SHIPLEY

Molecular volumes at absolute zero. III. Zero volumes, parachors and molecular diameters. SAMUEL SUGDEN. *J. Chem. Soc.* **1929**, 1055-8.—A comparison of Biltz's calcns. for zero vols. with those made by S. is given and the relationship of zero vols. to the actual dimensions of the mols. is discussed. Zero vols. and crit. vols. are in general not considered to be capable of accurate analysis as an additive function but will show deviations for those substances of which the mols. have peculiar intermol. fields.

J. W. SHIPLEY

Relation between ozone content of the lower and upper atmosphere. A. LEPAPE AND G. COLANGE. *Compt. rend.* **189**, 53-4(1929). Ozone measurements in the lower atm. at the Observatory of Montsouris show an equiv. thickness of 0.01-0.02 mm. as compared with 2-3 mm. found by spectroscopic means in the total atm. by Dobson (cf. *C. A.* **23**, 2612). The diurnal and annual variations found, however, parallel those of D.

GREGG M. EVAN

Observations of the height of the ozone in the upper atmosphere. II. F. W. P. GÖTZ AND G. M. B. DOBSON. *Proc. Roy. Soc. (London)* **A125**, 292-4(1929); cf. *C. A.* **22**, 4350. Correction of the spectrograph const. increases the previous results at Arosa about 18 km., making the av. height about 50 km., in agreement with results of other observers.

ARTHUR FLEISCHER

Demonstration of the interconversion of the two modifications of hydrogen. HERMAN SENFTLEBEN. *Z. physik. Chem., Abt. B.* **4**, 169-73(1929).—An app. is described whereby the interconversion of the 2 modifications of H may be demonstrated in a large auditorium. The method consists essentially of measuring the heat cond. of the 2 modifications before and after their ratios have been altered.

O. A. NELSON

The detection of the transformation of ortho-hydrogen into para-hydrogen by measurement of the specific heat. A. EUCKEN AND K. HILLER. *Z. physik. Chem., Abt. B.* **4**, 142-57(1929). Quantum mechanics requires the existence of two mol. modifications of H, which must show a difference in the first lines through the temp. range of their heats of rotation. While in ordinary H both modifications are present in the proportion of 1:3, for a perceptible increase of one modification at low temps. in the course of a few days the gas must be held under high pressure. The transformation is detected by an exact measurement of the mol. heats. For example the equil. concn. at 21.2° abs. is 99.7% para- and 0.3% ortho-H while at 170° abs. para-H = 25.3% and ortho-H = 74.7%. The exptl. procedure and some of the results obtained on the rate of transformation are given.

H. W. WALKER

The specific heats of para-hydrogen in solid, liquid and gaseous states. KLAUS CLUSIUS AND KURT HILLER. *Z. physik. Chem., Abt. B.* **4**, 158-68(1929).—Para-H is prepd. in large quantities at low temp. by the conversion and compression of electrolytic gas. The sp. heats of liquid and solid para-H and its heat of fusion within the limits of error agree with those for ordinary H. C_p for solid para-H at 11.09° abs. = 0.71 and at 12.46° abs. = 1.01. The m. p. = 13.88° abs. C_p for the liquid at 15.14° abs. = 3.45 and at 18.02° abs. = 3.92. The heat of fusion per mol. of para-H = 28.0 cal. Calcd. and observed values of C_p , the heat of rotation, are given for the temp. range 83.68° to 161.18° abs.

H. W. WALKER

Beryllium and helium. LORD RAYLEIGH. *Nature* **123**, 607(1929).—Since beryl contains He but no appreciable quantities of radioactive substances (*C. A.* **3**, 2651), the isotope Be^8 may have existed and have broken up as suggested by Atkinson and Houtermans (*Nature* **123**, 567-8(1929); cf. *C. A.* **23**, 3622).

B. C. A.

The vapor-pressure constant of neon. KLAUS CLUSIUS. *Z. physik. Chem., Abt. B.* **4**, 1-13(1929).—The sp. heat of solid and liquid Ne was detd. at 11° abs. Con-

sidering the difference $C_p - C_v$ one obtains for temps. below 16° abs. the value 63 for ϕ in the Debye equation for atomic heat. The heat of vaporization at 0° abs. was found to be 447.6 cal. The vapor pressure const. (integration const.) was detd. as 0.370 to 0.39, ± 0.04 , which is in good agreement with the theoretical value. O. A. N.

Dielectric constant of desiccated oxygen. HARRY L. RILEY. *J. Chem. Soc.* 1929, 1026-8. The specific induction capacity of O dried over P_2O_5 and over anhyd. $CaCl_2$ was measured to det. whether the change in chem. and elec. properties of desiccated gas was accompanied by some fundamental change in the structure of the gaseous mol. The method of Whiddington was employed in comparing the capacities of the 2 condensers contg. the gases. No change in the capacity of the condenser contg. P_2O_5 was detected during a period of 10 months. Apparently the action of traces of water vapor in promoting chem. activity cannot be explained by a change in the mol. structure due to drying. J. W. SHIPLEY

Kindling of phosphorus vapor in oxygen. A KOVÁLEK. *Z. physik. Chem., Abt. B*, 4, 288-98 (1929).—The oxidation of P vapor in O_2 takes place only between certain lower and upper limits of partial pressure of O_2 . The lower limiting pressure varies inversely as the pressure of P; the upper, directly. The intermediate pressure range is that of luminescent oxidation. The analogy between this phenomenon and the similar pressure limits for explosions is pointed out. At const. P pressure the upper pressure limit is independent of temp. between -10° and $+15^\circ$. The results are interpreted in terms of Semenov's theory. C. I. 22, 906 W. WEST

Ignition pressures of phosphine mixtures. MAX TRAPP and WILHELM GABLER. *Z. anorg. allgem. Chem.* 180, 321-54 (1929). Mixts. of PH₃ and O_2 ignite under diminished pressure which is not dependent upon the nature of the contg. wall. The conditions which det. ignition pressure are the compn. of the mixt., the H₂O content of the gases, the presence of foreign gases and temp. In general the ignition pressure increases with increased PH₃ partial pressure. It falls with increasing H₂O content of the gases, while with very dry gases it is not measurable as the reaction is instantaneous. The presence of N₂, Na_2O , H₂, CO, NH₃ and CO_2 causes but little fall in ignition pressure. With NO and the halogens the reaction is instantaneous. The ignition pressure rises sharply with increasing temp. Mixts. of CH₄, PH₃ and O_2 are not ignited by dilatation. CH₄ - PH₃ as an addnl. gas depresses the ignition pressure. Cloud formation is coincidental with ignition. The cloud is luminous in the dark and is markedly electrically conducting. Its optical d. decreases with increase of moisture. With dilatation of moist mixts. a transient cloud formation occurs which is not luminous in the dark. PH₃ alone causes cloud formation with H₂O vapor, but this disappears on dilatation. L. T. F.

Densities of molten potassium and sodium. E. RYDQVIST. *Chem. Zvest.* 189, 39-41 (1929).—In order to test the law of mass action of Lorenz (C. I. 18, 1466) on the system: $Na + KCl \rightleftharpoons K + NaCl$, a knowledge of the activities and therefore of the d_s of Na and K at the equl. temps. is necessary. The metal was contained in a Ni tube placed in the center of an Al block (30 kg.) and heated elec. by current from a battery of accumulators. The temp. was held const. to within 0.1° and measured by a thermocouple attached to a potentiometer sensitive to 0.001°. It was known with an error of less than 0.5%. A piece of Ni-plated Cu was suspended in the molten metal from a sensitive balance and from its wt. the required density was calcd. During the detn. a slow stream of N_2 was led through the metal. Measurements were taken between the limits 429 and 639.5° for Na and 525 and 535.5° for K. When d_s are plotted against temp. straight lines are obtained whose equations are, $d_s = 0.9385 - 0.00026(t - 96.5)$ [0.9835 in original is erroneous] and $d_s = 0.826 - 0.00022(t - 62.4)$. The equations give correct values at the m. p. and may be used for temps. of 800 (900°). J. M. LEVINE

Valence of sulfur in dithionates. RUTH E. WELCH and DON M. YOST. *Proc. Nat. Acad. Sci.* 15, 462-4 (1929). X-ray absorption measurements were made on $K_2S_2O_6$ to det. the valence state of the 2 S atoms. The result indicates that the S atoms are equiv. with a valence of 5. R. L. DODGE

Change of volumes and electric resistances of antimony and arsenic at fusion. H. PERLITZ. *Sitzb. Naturforsch. Ges. Univ. Tartu* 35, 121-5 (1928). Sb having been proved to expand during solidification, the diam. of the spherical domain of its atom is calcd. as 3.09 , and from 2 crystal lattice data as 3.04 and 3.06 A. U. The corresponding value for As from its crystal lattice is 2.75 A. U. From this value it is deduced that liquid As should expand during solidification by 5.1%, and it is estd. that the elec. resistance at the m. p. of liquid As is about 0.4 of that of the solid phase. B. C. A.

A singular point of iron. A. J. GUERON and S. GAGNEPAIN. *Helv. Phys. Acta* 2, 156-8 (1929).—The velocity of diffusion of H through Fe increases suddenly at about

200°; other (smaller) discontinuities in the curve of velocity of diffusion against temp. are found at the Curie point and at about 900° when β Fe changes into the γ modification.

Egon Bretscher

Magnetic measurements on iron single crystals and groups of crystals with new magnetic potential meter. H. GRIES AND H. FESSER. *Arch. Elektrotech.* 22, No. 2, 145-52 (1929).—Arrangement of app. is described and the influence of N, H and O on magnetic properties is expressed in curves.

E. I. S.

A comparison between the behavior at the A_{c3} point of single-crystal iron and polycrystal iron, both in the strained and unstrained state. H. QUINNEY. *Proc. Roy. Soc. (London)* A124, 591-603 (1929).—The energy per unit mass is less for single crystals than for polycrystals, while strain should increase the energy of the crystal. Single crystals, $1'' \times \frac{1}{4}'' \times \frac{3}{16}''$ were heated in a SiO_2 tube which was evacuated to prevent oxidation. No difference in the temp. of the A_{c3} point was detected but there was a difference in the temp. time curves, the single crystals falling below the polycrystals. The change from single crystals to polycrystals reduces the contraction at the A_{c3} point in the same ratio as the reduction in heat absorption.

Arthur Fleischer

The change of electric resistance of pure hafnium and zirconium between 1.3° and 90° K. W. J. DE HAAS AND J. VOOGD. *Proc. Acad. Sci. Amsterdam* 32, 707-9 (1929).—See C. A. 23, 1537.

E. H.

Mercury in chemistry and pharmacy. I. The history and production of the metal. G. MALCOLM DYSON. *Pharm. J.* 122, 496-7 (1929). The important uses of Hg are given. In thermometers for temps. above 360°, Hg may be replaced by Ga up to 600° in quartz instead of glass (cf. C. A. 20, 538). **II. The inorganic derivatives of mercury.** *Ibid.* 516-7. The chlorides and sulfides and their prepn., alembroth salt, etc., are described. **III. Medicinal and organic mercurials.** *Ibid.* 568-9. Notable examples of poisoning by Hg in vapor form are given. $HgEt_2$ is strongly poisonous, $Hg(CH_2CH_2CO_2H)_2$ is scarcely poisonous at all. Hg entering the mol. of phenols produces strong antiseptics. Mercuriophene (C. A. 16, 315; 22, 3629), mercuriochrome (C. A. 14, 3470; 15, 537; 22, 4651), uspulan (C. A. 17, 3397; 22, 3257) and gerimsan (C. A. 18, 1174; 21, 1325, 3249) are among the mercurial antiseptics discussed.

S. W.

Silver in chemistry and pharmacy. I. History and occurrence of the element. G. MALCOLM DYSON. *Pharm. J.* 123, 117-8 (1929). The methods of sepg. Ag from Pb by concn. and cupellation, or from Cu by electrolysis, from ores by amalgamation, as well as the uses of Ag, e. g., in making small mirrors, are included. **II. The compounds of silver.** *Ibid.* 213-4. The uses of Ag salts in photography, and of $AgNO_3$ and certain org. compds. of Ag in medicine (silver ar-sphenamine and haugoh) are referred to. In dispensing Ag_2O pills made by the interaction of $AgNO_3$ and $Ca(OH)_2$ with kaolin as excipient, it is unsafe to add creosote or alkali chloride during massing; sufficient heat would be generated to cause an explosion.

S. Waldbott

Molecular orientation and the partial vapor pressures of binary mixtures. I. Systems composed of normal liquids. C. P. SMYTH AND E. W. ENOEL. *J. Am. Chem. Soc.* 51, 2616-60 (1929). By a dynamic method, the partial vapor pressures of eight different sets of normal liquids such as CCl_4 , heptane, etc., were measured. The results fit into Langmuir's theory of mol. surface energies in an approx. fashion, the deviations being ascribed to elec. doublets in the mols. **II. Systems containing an alcohol.** *Ibid.* 2660-70. By a dynamic method previously described, the partial vapor pressures of six binary liquid systems were detd. Anale was one component in all cases, as for example heptane-butyl alc. The results show considerable deviation from Langmuir's theory of mol. surface energies. These deviations are thought to be due to interaction of electric doublets in the mols.

R. H. Ferguson

The hydrogen and carbon monoxide contents of some metals melted in a vacuum. A. VILLACHON AND G. CHAUDRON. *Compt. rend.* 189, 324-6 (1929).—Metals are melted in a vacuum of about $1/50$ mm. at 1700°, or $1/500$ mm. at 1000°, in Mg crucibles that have previously been heated at a very high temp. When the ingots obtained are made into leaflets $1/10$ -mm. thick, and heated at temp. below the m. p. they still evolve H_2 and CO, but no N_2 . After all the gas possible is evolved at a given temp., raising the temp. makes possible the removal of still more gas. Fe, Ni, Cu and Al gave this result. It is probable that in the liquid state hydrides and carbonyl compds. having very low disson. pressures remain dissolved in the metal.

Amy Levesconte

Electrical breakdown of solids. P. HÖNING. *Z. Physik* 56, 446-57 (1929).—The mechanism of elec. breakdown of solids is explained on the basis of ion adsorption on the inner surfaces of channels. Relations are obtained that give the dependence of breakdown potential on thickness and temp. Cf. Inge and Walther, C. A. 20, 1555.

George Glockler

States of mind which make and miss discoveries. With some ideas about metals. OLIVER LODGE. *J. Inst. Metals* 41, 345-76(1929).—A lecture. E. J. C.

Contact potentials between the same metals. WERNER ENDE. *Physik. Z.* 30, 477-80(1929).—Contact potentials between Ni-Ni, Pt-Pt and brass-brass were measured. The surfaces of the metal plates were treated with acids or by filing, sand blasting, etc., before making detns. The contact potential is conditioned by the surface layers and by suitable treatment of the latter can be done away with for the most part.

R. H. FERGUSON

Present status of the molecular field problem. FREDERICK G. KEYES. *Chem. Reviews* 6, 175-216(1929).—The origin of mol. fields and exptl. methods of apprehending these fields is discussed. Attractive and repelling fields are generally of the type λ_m^{r-m} and λ_n^{r-n} . Debye's theories of the fields due to displacements of electrons necessarily involve a knowledge of electronic structure. van der Waals forces may be evaluated from expts. on viscosity, heat cond. and diffusion. To these may be added results secured from refractive indices and light scattering, and Kerr's technic for estg. elec. double refraction. The bearing of mol. fields on the equation of state problem is finally discussed.

H. R. MOORE

Structure of the molecules of nitrogen, oxygen and fluorine. ADOLFO T. WILLIAMS. *J. chim. phys.* 26, 327-30(1929). A crit. discussion. F. URBAN

Variation of the molecular polarization of gases and vapors with temperature. I. Methyl ether, ethyl ether, propyl ether. R. SÄNGER AND OSKAR STEIGER. *Helv. Phys. Acta* 2, 130-44(1929).—From the variation of the mol. polarization ($P = (\epsilon - 1)M/3d$; ϵ = dielec. const., M = mol. wt.) with temp., the elec. moments of Me_2O ($\mu = 1.32 \pm 0.02 \times 10^{-18}$ e. s. u.), Et_2O ($\mu = 1.10 \pm 0.02 \times 10^{-18}$ e. s. u.), and Pr_2O ($\mu = 0.85 \pm 0.03 \times 10^{-18}$ e. s. u.) are calcd. by means of Debye's equation: $P = P_0 + 4\pi N\mu^2/3kT$. P_0 differs the more from the mol. refraction, extrapolated for infinite wave length, the larger the groups attached to the O bond. The vol. of the gas is kept const. during one expt. and the pressure varies proportionally with temp. according to the equation of van der Waals $p = C + DT$. The results agree with recent expts. made by Stuart.

EGON BRETSCHER

Direct determination of the electrostatic moments of molecules. R. J. CLARK. *Proc. Roy. Soc. (London)* A124, 689-98(1929).—Expts. indicate that the moments of As_2O_3 are of the right order of magnitude to agree with the theory of permanent dipoles put forward by Debye. The moment is not influenced by the strength of the field and is therefore a permanent characteristic of the mol. There seems to be no definite orientation of the mols., save parallel or antiparallel to the field. FRANK URBAN

The properties of dielectrics. I. Electric moment and molecular structure. C. P. SMYTH. *J. Franklin Inst.* 207, 813-24(1929).—Review with extensive historical bibliography. A. P. SACHS

Electric moment and structure of biphenyl derivatives. EGON BRETSCHER. *Helv. Phys. Acta* 1, 355-61(1928). The elec. moments of 4,4'-disubstituted biphenyl derivs. are calcd. from dielec. consts. and densities of dil. C_6H_6 solns. The app. used, and the prepn. and purification of the compds. studied are described. No elec. moment was found for biphenyl 4,4'-difluoro-, dichloro- and dibromobiphenyl. 4,4'-Diamino- and 4,4'-dimethoxybiphenyl possess an elec. moment of 1.43 and 1.52×10^{-18} e. s. u.; a plane configuration of the C_6H_5 rings is assigned to the compds. without dipoles. No explanation is given for the existence of an elec. moment of the amino and methoxy derivs.

EGON BRETSCHER

Electric moment of primary alcohols. P. C. MAHANTI AND R. N. DASGUPTA. *Indian J. Physics* 3, 467-75(1929); cf. *C. A.* 23, 2333. —The mol. polarization of several different solns in C_6H_6 of various alcs. was detd. by the Nernst bridge method. The current source was a microphone hummer of frequency 1000. The exptl. condenser was calibrated with several different liquids. Results: butyl alc.: mol. fraction 0 to 24.78, mol. polarization 26.46 to 41.40; hexyl alc.: mol. fraction 0 to 24.55, mol. polarization 26.46 to 41.97; octyl alc.: mol. fraction 0 to 15.26, mol. polarization 26.46 to 38.45; nonyl alc.: mol. fraction 0 to 19.15, mol. polarization 26.46 to 39.23; decyl alc.: mol. fraction 0 to 20.28, mol. polarization 26.26 to 41.64. For all of these and for $\text{C}_{11}\text{H}_{23}\text{OH}$, $\text{C}_{12}\text{H}_{25}\text{OH}$, $\text{C}_6\text{H}_5(\text{CH}_2)_2\text{OH}$ and $\text{C}_6\text{H}_5(\text{CH}_2)_3\text{OH}$, the dipole moments average 1.6×10^{-18} e. g. s. units. This agreement is attributed to the polarization of the O atom; the binding force acting on the C atom reacting with the O atom is thought to be the same whether the chain is long or short, open or closed.

WILLIAM E. VAUGHAN

Magnetic behavior of some organic crystals. S. BHAGAVANTAM. *Indian J. Physics* 4, 1-14(1929).—An app. to measure the principal magnetic susceptibili-

ties of small crystals is described. With this app. the ratios of the principal susceptibilities of iodoform, urea, succinic acid, azobenzene, *p*-nitrotoluene and anthracene were obtained. The results are discussed in relation to chem. constitution, crystal structure and magnetic birefringence.

H. W. LEAHY

Magnetic birefringence in liquids of the aliphatic series. M. RAMANADHAM. *Indian J. Physics* 4, 15-38(1929).—The app. consisted of a large electromagnet, giving 21,000 gauss, combined with a Rayleigh compensator. The least value of Cotton-Mouton const. possible to det. was $\approx 0.7 \times 10^{-14}$. R. made measurements on some 30 liquids belonging to the aliphatic series, namely, hydrocarbons, alcs., fatty acids, esters, unsatd. and satd. compds. The results are discussed in relation to chem. constitution. The C:O group favors pos. birefringence, whereas the CH_3 and OH groups favor neg. birefringence.

H. W. LEAHY

Elliptical polarization produced by reflection at the surface of solutions of fatty acids in water. CH. BOUHET. *Compt. rend.* 189, 43-5(1929); cf. *C. A.* 23, 3618.—The ellipticity produced by reflection of rectilinearly polarized light on aq. solns. of fatty acids, $\text{C}_8\text{--C}_{10}$, was measured. When the K 's (*Compt. rend.* 185, 53) are plotted against soly. in terms of satn., similar curves are obtained and K approaches a limit as the diln. is increased. This limit is equal to the value obtained for the soln. of propionic acid. Addn. of HCl has no influence on K , in contradistinction to the monomol. films of insol. acids. For the solns. having the limited ellipticity, the area occupied by each mol. of acid, calcd. according to the equation of Schofield and Rideal (*C. A.* 19, 3397), is in the neighborhood of 25×10^{-18} , in good accord with the exptl. value obtained by Adam (*C. A.* 16, 4107). The results confirm in a direct manner the hypothesis of orientation of mols. perpendicular to the surface of liquids, independent of the absorption equation of Gibbs.

I. M. LEVINE

Viscosity of vapors of organic compounds. I. TOSHIZO TITANI. *Bull. Inst. Phys. Chem. Research (Japan)* 8, 433-60(1929); Abstract sect. 2, 49-50.—A new capillary viscometer was devised to det. the viscosity of gases in small quantities at various temps.: the resistance of a Hg column moving through a narrow tube was taken into account. Measurements include 18 gases at temps. ranging between 20° and 120° . Sutherland's formula was found applicable with satisfactory results to all gases, and the consts. in the formula were computed for each. Mol. diams. of the gases were calcd. by the kinetic theory of gases. The values thus obtained agreed well generally with those computed from van der Waals's b , deduced from the critical data. A comparison of the cube root of the mol. vols. at b. p. with the true mol. diams. shows that they are almost proportional to each other, except with acetylene and allylene. The following are, resp., the viscosity at 0° ($\eta_0 \times 10^7$), Sutherland's const. C and the mol. diam. ($\sigma \times 10^9$): ethane 863, 287, 37; propane 751, 341, 42; butane 689, 336, 47; ethylene 907, 259, 36; propene 783, 322, 41; 1-butene 708, 329, 46; 2-butene: 694, 362, 45; 3-butene 732, 339, 45; 1-pentene 665, 368, 48; acetylene 954, 198, 37; allylene 808, 277, 41; trimethylene 807, 372, 39; Me_2O 850, 345, 39; MeCl 983, 380, 36; MeBr 1228, 379, 38; SO_2 1171, 396, 35; air 1711, 113, 31.

ALBERT L. HENNE

Microchemical crystal preparations. K. DIEDERICHS. *Mikrokosmos* 22, 181-4 (1929).—An elementary discussion (with photomicrographs) of the appearance of various cryst. salts under ordinary and polarized light with instructions for the prepn. of cryst. material for microscopic examn.

L. T. FAIRHALL

Reply to the criticisms of G. Mie and J. Hengstenberg and of H. Staudinger and R. Signer upon my work: Röntgenometric examination of highly polymerized organic substances. EMIL OTT. *Helv. Chim. Acta* 12, 330-1(1929); cf. *C. A.* 22, 728, 1879.—O. defends the existence of the lines questioned as well as the $(\text{CH}_2\text{O})_n$ mol. unit (*C. A.* 23, 1885).

C. H. PEET

The structure of silicates. C. GOTTFRIED. *Sprechsaal* 61, 57-9; *Chem. Zentr.* 1928, I, 2119.—The work of Bragg (*C. A.* 21, 1907) is reviewed. Crystd. silicates are considered structurally to consist of dense spherical packets in which the O atom is infiltrated between the Si and metal atoms. Because of their small size most metallic atoms have very little influence on the silicate structure.

C. R. FELLERS

The crystal structure of the A-modification of the rare earth sesquioxides. LINUS PAULING. *Z. Krist.* 69, 415-21(1929).—The structure found by Zachariasen (*C. A.* 20, 3597) for La_2O_3 , Ce_2O_3 , Pr_2O_3 and Nd_2O_3 is shown to be improbable. P. derives a new structure from the same data. The lattice dimensions are the same, with 1 mol. M_2O_3 , but there is a different arrangement of the O atoms, which are placed at 000; $1/2, 2/3, v$; $1/2, 1/3, \bar{v}$; with $v = 0.63$. The M positions are $1/2, 2/3, u$; and $1/2, 1/3, \bar{u}$ with $u = 0.235$. This new structure is in better agreement with interionic distances and with the structures of other oxides. A table of interionic distances is given. Reply.

WM. ZACHARIASEN. *Ibid* 70, 187-9. Z. considers the available data to be more in accordance with his derived structure than with that of Pauling. L. S. RAMSDELL.

Structure of basic acetate of zinc determined by x-ray analysis. J. WYART. *Bull. soc. franç. minéral* 49, 118-59 (1926). The crystals are isotropic; cleavage is parallel to (111). The crystals are transparent when freshly prepd., alter easily in contact with moist air, and are slightly sol. in CHCl_3 and C_6H_6 . The $d. = 1.903 \pm 0.003$. For x-ray work a crystal was rotated in $K\alpha$ of Cu; 8 mols. were found in the unit cell, the symmetry being probably Oh . B. E. TIFFANY.

X-ray investigation of the nitrides of manganese. GUNNAR HAGG. *Z. physik. Chem.*, Abt. B, 4, 346-70 (1929) = An x-ray investigation of the Mn nitrides, produced by heating Mn in NH_3 , shows the existence of 4 nitride phases. The one contg. least N exists only above 500° and is face centered tetragonal. On cooling below 500° this phase decomposes into two forms, one cubic and the other hexagonal close-packed. The phase contg. most N is again face centered tetragonal. Details of the method of prepn. of the nitrides are given and the mechanism of formation is discussed. J. B. AUSTIN.

Crystalline form, its importance in the formation of solid solutions. V. Thermal and x-ray analysis of the systems; cobalt chloride ferrous chloride and manganese chloride-ferrous chloride. A. FERRARI, A. CELEGI AND F. GIORGI. *Atti accad. Lincei* [6], 9, 782-9 (1929) = The m. ps. of various mixts. of $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$ and $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ change almost linearly with the compn. Thus as the % of FeCl_2 in the mixt. increases from 0 to 100 in steps of 20, the m. ps. of the mixts. with CoCl_2 are resp., 722°, 712°, 700°, 689°, 681°, 674° and in the mixts. with MnCl_2 650°, 652°, 656°, 661°, 668°, 674°. The crystallographic data show like similarities, the compds. being similar in crystal form as well as chemically. $d. = 1.9$, the side of the space lattice of a mol. of $\text{CoCl}_2 = 7.050 \pm 0.01 \text{ \AA}$, $\text{FeCl}_2 = 7.155 \pm 0.01 \text{ \AA}$, $\text{MnCl}_2 = 7.20 \pm 0.01 \text{ \AA}$; the vol. = 2.4748 cu. \AA^3 , 2.5860 cu. \AA^3 , 2.7222 cu. \AA^3 , resp.; the densities calcd. = 3.485, 3.254, 3.069. A. W. COSTIERI.

X-ray investigation of the mixed crystal system: barium sulfate + potassium permanganate. G. WAGNER. *Z. physik. Chem.*, Abt. B, 2, 358 (1929) = BaSO_4 and KMnO_4 possess the properties necessary for the formation of mixed crystals. The Debye-Scherrer diagrams were obtained for 10 preps. of varying permanganate content. Comparison of the lines obtained with those given by BaSO_4 and KMnO_4 alone shows a displacement. By plotting the lattice space against the permanganate content it is shown that the displacement is proportional to the latter within exptl. error. These facts are evidence for the mixed crystal nature of the BaSO_4 - KMnO_4 system. A photograph of BaSO_4 with adsorbed BaNO_3 gave no displacement of the BaSO_4 lines. B. C. A.

Aluminum and its formation of mixed crystals with silicon. Remarks pertaining to a publication under the same title by L. Anastasiadis. W. KOSTER. *Z. anorg. allgem. Chem.* 181, 295-7 (1929) = K. criticizes the technique employed and the results obtained by A. in the detn. of temp. coeff. of the soly. of Si in Al, and in measuring the elec. resistance of Al ref. *C. A.* 23, 2620. I. F. ATKINETH.

Banded structures in metal crystals. C. F. ELDM. *P. Roy. Soc. (London)* A121, 237-41 (1928) = Crystals of Al are rarely formed with a banded structure after treatment which would normally produce it, although the metal has the same crystal structure (face-centered cubic) as Cu, Ag and Au, which form twins of the spiral type. When a large Al crystal is strained about 10% and heated until it recrystallizes, the new crystals have very straight boundaries, and some of these take on the typical banded structure of twinned Cu. The plane of compn. can be the twin plane, but is not always so. Twins may be more common than hitherto supposed, but they may be overlooked because they are not united along the twin plane. There are also similar banded structures which are not of the spiral type of twin. In one example investigated, obtained when a crystal of aluminum in the form of a round bar was pulled in tension, the plane of composition had the indices {111}, so that the specimen, as a whole, can be considered as a reflection twin about this plane. This may be described as "mechanical twinning." In an appendix, G. I. TAYLOR discusses the connection between the formation of "mechanical twins" and the known manner in which Al crystals are distorted under tensile stress. If the laws previously discovered regarding the distortion of Al crystals are applied to the case of a tensile specimen of which the longitudinal axis lies in a cubic crystal plane and close to the normal to an octahedral plane, "mechanical twins" of the type described above might have been predicted as possible, and the orientation of the two sets of crystal axes would bear the same relationship to the plane of union and the longitudinal axis of the specimen as that actually found. B. C. A.

Spiral markings on Carborundum crystals. W. HUGHES. *Nature* **123**, 603-4 (1929).—When a film of molten S on clean glass cools, centers of crystn. appear, and rings grow outwards in succession from these points. When the logarithm of the no. of rings counted from a center is plotted against the logarithm of the distance of the rings, a straight line is obtained. The formation of the rings is ascribed to the evolution of latent heat on crystn. diminishing the surface tension of the surrounding S, which is then drawn outwards to form a circular ridge, this quickly crystg. and continuing the effect. The rings observed on Carborundum crystals by Menzies and Sloat (*C. A.* **23**, 4115) also give straight lines when the above data are plotted, and may have a similar origin. No particular significance is ascribed to the spiral nature of the markings. B. C. A.

The crystal structure of some binary compounds of the platinum metals. II. I. THOMASSEN. *Z. physik. Chem., Abt. B*, **4**, 277-87 (1929); cf. *C. A.* **23**, 3384.—Binary compds. of the Pt metals were prepd. and their crystal structures detd. by the x-ray powder method, as follows: (1) with pyrite structure, PtAs_2 with $a = 5.970$ A. U., PtP_2 with $a = 5.683$ A. U., RhS_2 with $a = 5.574$ A. U., and PtAs_2 , redetd. with $a = 5.957$ A. U.; (2) with NiAs structure, PtSb with $a = 4.130$, $c = 5.472$ A. U., and $c/a = 1.325$. The procedures for prepn. and tables of data are given. H. W. WALKER.

Crystal structure of dimethyldiethylammonium chlorostannate. RALPH W. G. WYCKOFF AND R. B. COREY. *Am. J. Science* [5], **18**, 138-44 (1929); cf. *C. A.* **23**, 3139. — Laue and spectral photographs from crystals of $(\text{Et}_2\text{Me}_2\text{N})_2\text{SnCl}_6$ have full tetragonal symmetry. The unit cell contains two mols. and has $a_0 = 9.06$ A. U., and $c_0 = 14.12$ A. U. In space group $4D_2$ Sn has the special position (a) and Cl (c) and (b) where u (for c) ≈ 0.17 and w and v (for b) \approx about 0.235 and 0.13, resp. The structure as a whole is probably a distorted CaF_2 (or $\text{CNH}_4\text{SnCl}_6$) arrangement. The N atoms are then at (d) of $4D_2$. The distribution of the C atoms about these N atoms was not found. Probably the crystal has s -symmetry and space group less than holohedral. H. W. WALKER.

Structure of the crystalline part of cellulose. II. H. MARK AND KURT H. MEYER. *Z. physik. Chem., Abt. B*, **2**, 115-45 (1929). Work on the x-ray diagrams of cellulose has shown that it is made up of elementary cells, in monocline form. An at. model is here put forward for the structure of cellulose which will give values for the intensities of the diagram in agreement with those observed. The size and form of the cellulose micelle are calcd. It has a length of about 500 and a width of about 50 A. U. The mechanisms of reactions into which cellulose can enter are considered. The micellar structure of cellulose leads to two types of reaction, (a) the micellar surface reaction, and (b) the "permutoid" reaction. The latter is the more important. By the use of Hudson's rule, the rotations of various cellulose derivatives are calcd. and found to agree with the observed values. An x-ray method for the comparison and identification of cellulose preps. is given and the question of small structural elements of cellulose is discussed (cf. *C. A.* **23**, 1263). B. C. A.

X-ray diffraction in liquids and solutions and the molecular structure factor. P. KRISHNAMURTI. *Indian J. Physics* **3**, 507-22 (1929); cf. *C. A.* **22**, 4291; **23**, 1348, 4116. Substances consisting of sym. mols. were examd. in the liquid state and in solns. of different concns by the Debye-Scherrer method using $\text{Cu K}\alpha$ radiation. Tetranitromethane, belonging to the cubic system, gave 2 rings for the liquid having spacings 5.49 and 3.02 A. U., resp., whereas in a dil. soln. in benzene or cyclohexane a strong scattering at smaller angles and a faint max. at 3.02 A. U. were observed. The strong inner ring is due to diffraction by neighboring mols. and hence is intermol., while the faint outer ring is due to the structure factor of the mol. and hence is intramol. A study of dil. solns. is of value in detg. the structure factor of the mol. In a concd. aq. soln. of hexamethylenetetramine a broad inner max. and an outer one at 2.86 A. U. were observed. Dil. solns. of CCl_4 in cyclohexane gave faint outer max. in approx. the same position as in the pure liquid, supporting the view that the outer ring of the liquid owes its origin to the mol. structure factor. It is suggested that it is not the distance between neighboring mols. but the distance between the planes containing the max. no. of mols. per unit area which should be considered. The use of hexamethylenetetramine powder for standardizing an x-ray camera when using soft radiation is pointed out. H. W. WALKER.

Determination of molecular forces from the viscosity of a gas. H. R. HASSE AND W. R. COOK. *Proc. Roy. Soc. (London)* **A125**, 196-221 (1929).—A math. study in kinetic theory. The object of the investigation was "to compare the values of the force consts. detd. by the variation of viscosity with temp. with those obtained from the deviations from Boyle's law, and further to obtain a formula for the viscosity which is

based on a mol. model in which an elastic sphere plays no part." The repulsive force between 2 mols. was assumed to be of the form λr^{-9} and the attractive force μr^{-5} , where r is the distance between the mols. and λ and μ are the force consts. Fairly satisfactory agreement of the calcs. with expt. were found for A, H₂, N₂, CO₂, air and Hg over a limited range of temp.

F. L. BROWNE

Investigations in the critical region. III. Energy measurements by means of the Joule-effect. K. RENNERTZ AND N. ANDREEV. *Z. physik. Chem., Abt. A*, **142**, 37-66(1929).—The energy relationships in the crit. region were detd. for A, N₂, O₂, CO₂ and CH₄ by means of the isothermal Joule effect using a Rudge calorimeter of 8.84-cc. capacity for CO₂ and a newly designed calorimeter (modification of Simon) for the other gases. In the new app a Pt resistance thermometer was used. Small quantities of impurities were without effect on the detns; hence no effort was made to use highly purified gases. The reduced Joule curves for T_h coincide for all the gases except CO₂; this indicates that the rotational energy remains practically unchanged during the expansion even from high initial d. The usually accepted crit. point does not coincide with the one to be expected from energy relations. The variance of CO₂ from the normal curve indicates assocn. At the crit. point diss. en. is 93%. The energy of assocn. $U_a = -8765$ cal/mol (CO₂). Diagrams of app are given. The crit. values T_c, p_c, and d_c are: O₂ 154.38°, 49.71, 0.441; N₂ 125.07°, 33.49, 0.311; CH₄ 190.7°, 45.7, 0.162; A 150.76°, 48.0, 0.5308; CO₂ 304.5°, 72.92, 0.461. E. R. S.

Solvent vapor-air mixtures. L. PIERI. *Chem. Abstr.* **16**, 105.7(1920).—Analytical and graphical methods are given for detg. sp. gr. of vapor-air mixts. Proper construction of ventilating systems for removal of these vapors is considered. M. C. ROGERS

Mixtures of anhydrous alcohol and ethyl ether. M. DE-MAROUX. *Mém. poudres* **23**, 198-229(1928). Tables and charts of mixts. of EtOH and Et₂O are shown, with regard to mol. vol., vapor tension, heat of mixing, cond. f. p. and m. p. The m. p. curves show 3 maxima corresponding to 1 mol. of EtOH to 1, 3 and 5 mols of Et₂O.

A. J. PHILLIPS

The surface tension of binary liquid mixtures containing an associated component and a non-associated one. K. M. STALHORSKI. *Z. Physik. Chem.* **35**, 185-6(1920).—The degree of assocn. of a liquid is calcd. from measurement of the surface tension of its concd. soln. in a non-assocd. liquid, by means of the equation: $X = \frac{\gamma_1(1 - (\gamma_1/\gamma_2))}{\gamma_1(1 - x)(\gamma_2/\gamma) - 1}$,

where X is the assocn. factor of the liquid investigated in pure state, $\gamma_1, \gamma_2, \gamma$ are the surface tensions of the soln., the assocd. and non-assocd. liquids, resp., and x is the molar concn. of the assocd. compd. computed on the basis of single mols. The assocn. consts. of Me₂CO at 18.2° and of MeOH at 25.2°, computed from measurements of their solns. in C₆H₆ and in Et₂H, resp., are 1.42 and 3.16, resp.

ALBERT L. HENNE

Surface tension and the interference effect of disturbed surfaces. Z. V. VOLKOVA AND V. S. TITOV. *Z. physik. Chem., Abt. B*, **4**, 71-82(1920). The effect of adding sol. inorg. substances that increase surface tension, on the interference effect of disturbed surfaces was investigated. The addn. of these substances to H₂O made the interference effect more stable and permanent, whereby it was shown that the concn. of the soln. and the deflection of the rays were in a linear relation to each other. These results might be explained by the hypothesis of a layer of particles, present to a certain height above the disturbed surfaces.

O. A. NELSON

Measurements of surface tension in the laboratory and in the plant. H. CASSEL. *Chem.-Ztg.* **53**, 479-80(1929). A new bubble pressure app. is described which is well adapted to use in technical as well as in scientific work. The capillary opens upward, making smooth liberation of the bubbles possible. The danger of clogging is materially reduced by applying a conical capillary nozzle instead of a capillary tube. The nozzle is automatically rinsed before each measurement. The app. consists of two parts to be united by means of a ground joint, (1) a bottle-shaped receptacle, having a capillary nozzle, for the liquid to be tested; (2) a manometer fastened on a stand. The app. is made in two different manners, one reducing, the other increasing the pressure for the generation of bubbles. The first method is sufficiently accurate for technical work while the latter is more adapted for scientific precision measurements. Detn. of surface tension is made by filling the receptacle with liquid to one cm. above the capillary nozzle, pressing the rubber ball to cause bubble formation and adjusting the movable scale with the mark, indicated by the sp. gravity of the liquid, to the lower meniscus of the manometer. The surface tension is then read off the scale at the upper meniscus of the manometer. The operation can be repeated without refilling the receptacle. The app. is standardized by using pure water at room temp. and converting the reading

into dynes/cm. by multiplication with the obtained gage factor. The special features of the app. for technical applications are accuracy with ease of handling, direct reading and speed.

G. H. VON FUCHS

The steady motion of viscous, incompressible fluids; with particular reference to a variation principle. CLARK B. MILLIKAN. *Phil. Mag.* 7, 641-62(1929).—Only in exceptional cases is it possible to deduce the equations of steady motion of a viscous, incompressible fluid from a variation principle involving a Lagrangian function contg. only the velocity components, their first-order space derivs., and possibly functions of the coordinates. Lagrangian functions for the exceptional cases are shown and the corresponding variation principles are found to be of one form, except for functions of the coordinates.

L. H. REYERSON

Protective evaporation at low temperatures. Direct condensation of the vapors by means of water or ice. ERNST JANTZEN AND HANS SCHMALFUSZ. *Chem. Fabrik* 1929, 387-91, 399-401.—App. is described that may be made in the ordinary lab. for rapid and economical evapn. of solns. near the freezing point, with sample calcs. and 17 references. Cf. *C. A.* 19, 1067; 23, 1186.

J. H. MOORE

The vapor pressure of tetralin. I. PIATTI. *Erdöl u. Teer* 23, 421-4(1929).—The poor agreement in b. p. of $C_{10}H_{12}$ in the literature is due to impurities of higher and lower hydrogenated products. Various com. samples vary over 10^2 in boiling range. The vapor pressure of a middle fraction b. 203-6° was 0.43 mm. at 25° and agreed well with the equation of Herz and Schafton (*C. A.* 16, 3015).

A. W. F.

Determination of the hydrogen value of unsaturated compounds. H. I. WATERMAN, J. N. J. PERQUIN AND H. A. VAN WESTEN. *J. Soc. Chem. Ind.* 47, 363 5T(1928).—A new method for the detn. of the H value of unsatd. compds., especially suitable for substances having high vapor pressures, is described in detail. Hydrogenation is performed in the presence of a catalyst, and the volume of gas absorbed is measured directly.

B. C. A.

Vapor pressures in small capillaries. I. Water vapor. II. Toluene. J. L. SHERESHEFSKY. *J. Am. Chem. Soc.* 50, 2966-80, 2980-5(1928).—The vapor pressure of water in glass or quartz capillaries was measured by exposing capillaries contg. water to the vapor of dil. solns. of known vapor pressure and measuring the rate of condensation or evapn. of water in the capillary. The pressure at which the rate of evapn. or condensation is zero, and is equal to the vapor pressure of the water in the capillary, is then obtained graphically. The lowering of vapor pressure of water is much larger than that calcd. by Kelvin's equation; the large value is probably to be attributed to an increase in the surface tension of the liquid in the capillary. The abnormally great lowering observed in glass capillaries is due to the soly. of the glass. In similar expts. with toluene, results are obtained which are not in agreement with the classical theory; this theory is believed to be incorrect.

B. C. A.

Adsorption of gases and vapors and Langmuir's theory. H. ZEISE. *Z. Elektrochem.* 35, 426-31(1929).—Both of the coeffs. in Langmuir's adsorption isotherm vary with temp. Polanyi has maintained that L's. theory of adsorption requires one of these coeffs. to be independent of temp. and that the theory is therefore invalid. Z. now shows that the variation of the coeff. in question with temp. can be explained satisfactorily on theoretical grounds. Even for the adsorption of vapors, L's. theory is applicable within the limits set on the one hand by the region of powerful combination with very large heat effects (monomol. layers) and on the other hand by the appearance of two- and three-dimensional condensation (polymol. layers) which may sometimes set in from the beginning of adsorption and may sometimes appear later on.

F. L. B.

Fundamentals of the potential theory of adsorption. M. POLANYI. *Z. Elektrochem.* 35, 431-2(1929); cf. preceding abstr.—The potential theory of adsorption differs from Langmuir's theory fundamentally in that it regards the ordinary forces of cohesion between mols. of gas or vapor as still operative in the presence of the forces of adsorption. L's. theory neglects the forces of cohesion. The potential theory does not postulate explicitly adsorption forces of long range as distinguished from forces of mol. range only. Until further exptl. data are available, it is idle to discuss the question of the applicability of the potential theory to monomol. adsorption.

F. L. BROWNE

The adsorption of a gas. YOZO KOBAYASHI. *Chem. News* 139, 153(1929).—For the monomol. adsorption of a gas on a solid, by assuming that the adsorbed mol. behaves as a two-dimensional gas mol. assoc. with a small vibration perpendicular to the adsorption surface, $\eta = (\theta/\omega)c + (1 + \theta c)$, where θ contains λ as a function of temp., λ representing the mean free path for translational motion of the adsorbed mols., and ω is the area occupied by an adsorbed mol.

F. L. BROWNE

Low-pressure adsorption on a washed glass surface. HENRY S. FRANK. *J. Phys.*

Chem. 33, 970-6(1929).—The adsorption of water vapor on an acid-washed surface of Pyrex was measured at pressures ranging from 5.2×10^{-3} to 8.7×10^{-2} mm. of Hg. A known amt. of water vapor was introduced from a capsule into a space of known vol. at a known temp and the pressure measured with an all-glass membrane manometer. The results show that the adsorption process is slow and also reversible.

P. T. NEWSOME

The heat of adsorption of gases by solids. K. F. HERZFELD. *J. Am. Chem. Soc.* **51, 2608-21(1929). The puzzling cases in which the heat of adsorption increases with increase in the amt. adsorbed are explained by the interaction of polarized (in the sense of oriented) molecules adsorbed at a surface with the gas mols. ARTHUR FLEISCHER**

The influence of hydrogen-ion concentration on the adsorption of weak electrolytes by pure charcoal. HAROLD J. PHELPS AND RUDOLPH A. PETERS. *Proc. Roy. Soc. (London)* **A124, 554-68(1929)** Com. norite was purified with HCl and HF by the Miller method. After heating *in vacuo* the ash content was 0.07%. The activity of the purified C for HCl was 1 , the activity of the untreated material. The adsorption of propionic, caproic and succinic acids increases with decrease in the p_H of the solns, the rise corresponding to the K_a value. For propylamine and butylamine the adsorption increases with increase in p_H , although the rise is not as sharp as for the acids. Alanine, glycine and aspartic acid were not adsorbed at any p_H , confirming Michaels' statement. Histidine and histamine follow the same curve up to p_H 7.3, above which the adsorption of histamine increases while the adsorption of histidine decreases. The data agree with the rule that the adsorption proceeds through the medium of unionized mols. The results agree with those of Langmuir if the C surface is uncharged.

ARTHUR FLEISCHER

Adsorption of fumaric and maleic acid by pure charcoals. HAROLD J. PHELPS. *J. Chem. Soc.* 1929, 1724-7; cf. preceding abstract. The acids (20 cc of 0.27% solns) together with suitable small vols. of H₂SO₄ or NaOH were made up in every case to 22 cc and shaken with 200 mg. charcoal, purified by Miller's method. The adsorption of maleic acid, which is ml in solns more alk. than p_H 7, rises steadily with increasing H-ion concn. up to p_H 1.5, the most acid soln. with which it was possible to work. The adsorption of fumaric acid rises from ml at about p_H 7 to become a max. at about p_H 3.7. These results seem consistent with the view that with fumaric acid only the doubly ionized mol. escapes adsorption, while with maleic acid the product of the primary ionization is adsorbed to a less degree than the neutral mol. and the doubly ionized mol. is scarcely adsorbed at all. There is every reason to suppose that the stronger CO₂H group of maleic acid hinders adsorption more on account of its proximity to the weaker unionized group than from any other cause.

C. J. WEST

The adsorption of certain acids by wool. W. W. PETERS. *J. Phys. Chem.* **33, 1107-8(1929)**—At the temp. of boiling water wool adsorbs tartaric acid much less than it does either HCl or H₂SO₄. The adsorption curves show no evidence of the formation of chem. compds.

P. T. NEWSOME

Study of the role of dielectric constants, polarization and dipole moment in colloidal systems. V. The swelling of acetylcellulose in binary mixtures. I. LEONID SAKURADA. *Kolloid. Z.* **48, 353-61(1929)** By methods previously described (Oswald, *C. A.* **22, 4031**; Sakurada, *C. A.* **23, 4865**) the swelling of acetone sol. acetylcellulose was studied in binary liquid mixts. The two weakly dipolar substances PhH + CCl₄, PhH + CS₂ do not cause swelling either alone or in mixts. The curve polarization-concn. of the mixts. is linear and almost horizontal. With mixts. of a weakly dipolar, with a polar substance (PhH + Et₂O or MePh, ClPh, NO₂Ph, CH₂Cl₂, CH₃CO₂Et; or CCl₄ + Et₂O or CH₃CO₂Et, Me₂CO) the polarization curves are sometimes linear (CCl₄ + Et₂O; PhH + MePh, but usually curved. When the mixt. contains one polar non-associating liquid the Q (swelling) curve and the total polarization curve are similar and often linear, if the second liquid is polar but associating or contains heavy atoms or groups (halogen or nitro) neither curve is linear. With NO₂Ph in PhH they are similar, with halogen derivs. they are concave toward each other. A close relation between total polarization and swelling exists, but it is not possible to formulate any generalizations. The dielec. structure of the individual mols., i. e., the difference between nuclear charges C, H, O and halogen, apparently has an influence on the swelling. Data for 6-8 combinations of each mixt. are given. E. R. S.

The refractive indices of hydrosols. A. DUMANSKI AND B. S. PUCHKOVSKI. *Kolloid. Z.* **48, 338-42(1929)**. In 1917, Wiegner published (*C. A.* **11, 2236**) the following formula to express the n of a hydrosol. $n = c_1 \{ (n_2 - n_1) d_2 \} + n_1$, where n_2, n_1 and n are the refractive indices, resp., of the sol, the dispersing medium, and the disperse phase, d_2 = the thickness of the disperse phase and c_1 = a function of the concn. An

identical formula was published by D. and Tarassov in *Mem. landw. Inst. Woronesch* 1(1915). Recent expts. with sols of silicic acid, stannic acid, molybdic acid, Zn hydroxide, casein and dextrin have demonstrated that the term $(n - n_0)/c_1$ is a const. as the formula demands. Exceptions noted with the sols of molybdic acid and casein may be explained by a change in the condition of the colloidal particles on diln., i. e., the sol tends to become a true soln. DON BROUSE

Electrical conductivity of thin oil films. I. General nature of the phenomenon. H. E. WATSON AND A. S. MENON. *Proc. Roy. Soc. (London)* A123, 185-202(1929).—Static friction measurements have been made by means of an app. somewhat similar to that used by Hardy (cf. *ibid* A108, (1925)). With "wiped films" the result obtained by Hardy, that the coeff. of friction μ decreases considerably with increase of pressure, was confirmed. Microscopical examn. and measurements of the thickness of these non-conducting films suggested that they consist of a no. of small oil globules between 2 adsorbed films of air or water vapor on the metal surfaces. There is no relation between the value of μ and the thickness of the film. Air films have a high insulation resistance, and when they break down the resistance usually becomes very low. "Flooded films" of paraffin oil will withstand a high potential gradient (over 100,000 volts/cm) as long as their thickness is greater than about 15μ . Thinner films (below 11μ) break down frequently on application of 2-40 v. and become partially conducting. The breakdown thickness does not vary much with the voltage. The film becomes conducting in two stages: in the first the resistance is of the order of 1 megohm; in the second it is very low. With both films the c. m. f. increases with the current for small values of the latter, but Ohm's law is not obeyed, with larger currents the c. m. f. becomes nearly const. and on still further increase it decreases. B. C. A.

Colloid chemical factors in the formation and breaking of crude-oil emulsions. A. LOTTERMOSER AND NICOLAS CALANTAR. *Kolloid-Z.* 48, 362-77(1929). The effectiveness of casein as an emulsifier for petroleum from Baku was tested. In general casein forms oil in water emulsions provided purified petroleum is used, but with an impure oil or when there are hydrophobic colloids in the oil, both types of emulsions may result in appropriate ranges of concn. Asphalt resin and petroleum tar are such hydrophobic colloids and serve as emulsifiers for water in oil emulsions. They lower the interfacial tension between oil and water, are adsorbed at the boundary, and form elastic skins enclosing the water. By raising the viscosity of the petroleum they aid further in stabilizing natural petroleum emulsions. Asphalt resin forms emulsions of greater stability than petroleum tar. Natural petroleum emulsions may be broken by extg. the tar with NaOH. On shaking with fuller's earth to adsorb asphalt resin, the emulsions are broken. Spontaneous breaking of emulsions is accomplished by pptg. tar and asphalt with SnCl_4 . The lowest fractions of petroleum are weakly emulsified because they are lowest in viscosity and in content of emulsifying colloids and differ most from water in sp. gr. F. L. BROWNE

Flocculation of sols of arsenic sulfide by thorium chloride. A. BOUTARIC AND C. SEMELET. *J. chim. phys.* 26, 195-201(1929). B. previously studied the effect of uni-, bi- and tervalent cations on the flocculation of As_2S_3 sols (C. A. 19, 919). Quadrivalent Th is now studied. Below a certain concn. of ThCl_4 there is no flocculation; above this threshold concn. the time of flocculation varies inversely with the concn. and finally becomes practically instantaneous. No reprecipitation at higher concns. of ThCl_4 was observed. The flocculation takes place more slowly the higher the concn. of the sol, the smaller the particle size, the higher the temp., and in the presence of MeOH, EtOH, MeAc and As_2O_3 . Saccharose has no effect. A. C. HIGGINS

The suspensions of kaolin in various media. RENÉ DUBRISAY, JEAN TRILLAT AND ASTIER. *Compt. rend.* 189, 41-3(1928). Kaolin was suspended in H_2O and in various concns. of NaOH, KOH, LiOH, $\text{Ca}(\text{OH})_2$, $\text{Ba}(\text{OH})_2$, H_2SO_4 , H_3PO_4 , HNO_3 and HCl, shaken mechanically for 12 hrs. and allowed to settle until the vol. of the deposit remained const. This settling period varied from 4 to 5 days for the flocculent ppts. to 1 month for the weak alk. media. For the suspensions in the alkalies and alkaline earths a min. thickness is obtained at concns. of N, 34 and N, 180-270, resp. At these points the supernatant liquid approaches most closely a colloidal suspension. In the acid media the change in thickness with the concn. is much less than in the bases and, moreover, no min. is obtained. The variation in the thickness of the deposit is due to the water interspersed between the particles of kaolin, for when the mixt. is centrifuged the same vol. of deposit is obtained regardless of the medium. The structure of the deposit was studied by means of x-ray spectra. In pure water and in the sols, where the thickness is greatest the particles take the form of annular rings, identical

among themselves and to that of dry kaolin. In the other media the thickness of the ring is increased and the intensity diminished.

I. M. LEVINE

Some data on obtaining colloidal gold for use in the Lunge reaction, used in electrolyzed water to produce aerosols. RAUL WERNICKE and FERNANDO MODERN. *Anal. asoc. quim. Argentina* 16, 247-56 (1928).—See C. A. 23, 2199. E. M. S.

The lyotrope series and the antagonistic action of ions. W. W. TAYLOR. *Proc. Roy. Soc. Edinburgh* 49, Pt. 3, 198-209 (1928-29).—When the univalent anions are arranged according to their pptg. concn. for a $\text{Fe}(\text{OH})_3$ sol the sequence is lyotropic: acetate, CNS, Cl, Br, NO_3 , ClO_3 , I. Only thiocyanate is in an unusual position. The order for cations is also lyotropic: Li, Na, Mg, K, Rb, NH_4 , Ca. The pairs of univalent-bivalent cations Li and Mg, K and Ca—show no trace of antagonistic action in the pptn. of $\text{Fe}(\text{OH})_3$ sol. The results are additive. The pair of univalent-bivalent anions— ClO_3 and SO_4 —shows a well marked adjuvant action which amounts to 50%. The effect of salts on the opalescence temp. of a phenol-water system is lyotropic. The order is: anions—Cl, Br, NO_3 , I, CNS; cations—Na, Li, K, NH_4 . The effect of valency is slight or non-existent.

DON BROUSE

A mechanism of gelatinization. FRANCIS L. USHER. *Proc. Roy. Soc. (London)* A125, 143-51 (1929).—"Suspensions of typically lyophobic materials such as gamboge and CdS can be caused to gelatinize when mixed with NaCl solns. of suitable concn. The process was followed microscopically with gamboge and found to consist in the union of single particles to form expanded aggregates which eventually link up (if a sufficient proportion of the solid is present) to form an irregular and essentially open structure. The degree of compactness ultimately attained depends on the electrolyte concn., the packing itself being partially due to internal Brownian movement in initially linear aggregates. It is clear that if the solid framework of a rigid 2-phase system becomes thickened in consequence of such internal packing, the system itself must become physically heterogeneous, and this appears to be an adequate explanation of *syneresis*. When the electrolyte is sufficiently concd. the particles unite to form dense aggregates so rapidly that there are not enough available for linking these up into a coherent structure and the result is a ppt. A gel is, therefore, to be regarded as an intermediate stage in the formation of a ppt., a stage which, however, is realized only when the vol. of the solid phase bears a large enough proportion to that of the liquid, and in the presence of a suitable electrolyte at a concn. lying between narrow limits." This mechanism of gelatinization applies only "for colloidal systems which can be induced to gelatinize by addn. of electrolyte, and not for turgescible substances like gelatin or agar" or for gels (rubber) formed in non-ionizing liquids.

F. L. BROWNE

The influence of volume on swelling. DOROTHY JORDAN LLOYD. *Kolloid Z.* 48, 342-5 (1929). The swelling of purified (isoelec.) gelatin in aq., salt or acid soln. is independent of relative vol. provided that no hydrolytic decompn. has occurred. Reports in the literature, which indicate an increase of swelling with vol. are usually based on expts. with com. gelatin contg. 1 or 2% ash (usually CaSO_4). In an alk. soln. the swelling of purified gelatin increases with an increase in vol. because of hydrolysis which always takes place in an alk. soln. The influence of an increasing vol. of liquid on the swelling of com. gelatin depends upon the decrease of the relative concn. of the impurities.

DON BROUSE

Studies on the swelling of gelatin in aqueous solutions of acids, bases and salts, and of mixtures of the same. A. KÜNTZEL. *Biochem. Z.* 209, 326-437 (1929).—The swelling of gelatin in aq. solns. of acids or bases and its swelling in solns. of salts are regarded as fundamentally the same phenomenon. Two sep. effects of an electrolyte soln. on gelatin must generally be distinguished, both of which influence the degree of swelling: the charging of the gelatin through adsorption of electrolytes and the process of peptization. K. therefore differentiates between "electrical" and "peptization" swelling. Whenever gelatin swells under the influence of electrolytes both types of swelling occur. However, in the case of acids and bases the elec. phenomenon predominates, in salts solns. the peptization. The elec. swelling reaches a max. in the same electrolyte concn. where the adsorption of electrolyte is likewise the greatest. The degree of elec. swelling is detd. by the adsorbability of both ions of the electrolyte. If both ions are about equally strongly adsorbed, the resulting swelling is small (neutral salt effect), but if one or another ion is more strongly adsorbed the swelling is great (acid or bases). The basis of the elec. swelling is the binding of electrolytes by gelatin; this however is an adsorption of single ions and not a salt formation between an amphoteric protein and acids or bases as must be concluded from the following considerations. The similarity of swelling in acids, bases or salts indicates a similarity in the mode of combination. The acid-binding capacity has no definite value but is different for each

acid, depending upon the adsorbability of its ions and its dissoen. const. Finally, in the acid binding by gelatin only the dissoed. and not the undissocd. part plays a role. According to their behavior toward gelatin electrolytes can be grouped in 2 classes: cationophile and anionophile. In electrolytes of the first groups the cation is more strongly adsorbed than the anion (acids; CaCl_2) while in the electrolytes of the second group the anion is more strongly adsorbed (NaOH ; NaCl). This differentiation is especially justified when one studies the combined action on swelling of several electrolytes. Only 2 types of combined action occur, an additive and an antagonistic, and electrolytes of the same class always show the additive effect while the electrolyte of one class is always antagonistic in action against electrolytes of the other class. Criteria are discussed to distinguish between additive and antagonistic actions. The antagonism between cationophile and anionophile electrolytes is polar in nature; i. e., it depends upon the antagonism of oppositely charged ions, and a non-polar antagonism between similarly charged ions does not occur. When 2 antagonistic electrolytes are combined in such a way that the gelatin is equally charged positively and negatively through adsorption of cations and anions, the gelatin is in an isoelec. condition. This therefore depends upon the concn. ratio of the ions present but not of the H-ion concn. alone, and gelatin can be put into the isoelec. state at any p_{H} value. There is no second isoelec. point. The peptization swelling results from the combined effect with the elec. swelling. That is, peptization occurs without swelling but the presence of elec. charges causes an increase in the elec. swelling, and the name is applied to this increment. The peptization increases steadily with rising concn. of electrolyte, but not as in the case of the elec. swelling to a max. followed by a decrease. Each electrolyte produces a different peptization effect, and the greater the molar soly. the greater is its peptization ability. This rule seems to be more applicable than the Hoffmeister series, which neglects the opposite ion. By proper choice of the latter the Hoffmeister series can be easily altered. The cause of peptization is apparently the removal of structural water.

S. MORGULIS

Casein. III. The fractionation of casein. K. LINDERSTRÖM-LANG. *Compt. rend. trav. lab. Carlsberg* 17, No. 9, 116 pp (1929); cf. *C. A.* 20, 1934. —A sample of casein was treated with a 0.002 N 60% alc. soln. of HCl and the sol. part sepd. from the insol. part by filtration. By successive treatments of the ppts. with alc. HCl a series of several such fractions was obtained. The dissolved material in the filtrates was pptd. with NaOH. The properties of the substances obtained in this way were compared with those of the original casein, with those of a mixt. composed of the fractions produced by the above treatment, and with those of the filtrate and ppt. obtained by treating casein with HCl and NaCl in aq. soln. Comparisons were based on the % N, % P, arginine, histidine, tyrosine- and tryptophan-N, acidity as detd. by electrometric titrations, sp. rotation, soly. in 60% alc., in HCl-NaCl solns., calcd. mean valence, fractionation with CaCl_2 , rate of coagulation with rennet, rate of digestion with trypsin-kinase, and titration with formol. The properties of the mixt. contg. the component fractions were found to agree, within exptl. error, with those of the original casein, but those of the individual fractions frequently did not. The properties of the material in the ppts. tend to deviate from those of the original casein in a direction opposite to that of the material in the filtrates. The author concludes that casein contains several kinds of colloidal mols. which mutually interact and hence follow through the processes to which casein is generally subjected, forming a co-pptn. system. One of the substances present appears to be a basic, alc.-sol., P-free protein; a second is believed to be a combination of the first with a P-contg. substance, sol. in the presence of Ca salts; a third contains still more P than the second and is pptd. with Ca salts. The work is considered to be of a preliminary nature. 113 references are included.

CORNELIA T. SNELL

The velocity function of the viscosity of disperse systems. G. W. SCOTT BLAIR. *Kolloid-Z.* 48, 283 (1929).—Correction of translation into German of article in *Kolloid-Z.* 47, 76 (*C. A.* 23, 1798).

A. P. SACHS

Absorption velocity of gases by liquids. I. Absorption of carbon dioxide by potassium hydroxide solution. S. HATTA. *Tech. Repts. Tôhoku Imp. Univ.* 8, 1-25; *J. Soc. Chem. Ind. (Japan)* 31, 869-70 (1928); Suppl. Binding 31, 210B.—The rate of absorption of CO_2 by KOH soln., when mixed with air, has been investigated. By using 2 independent stirrers the thicknesses of the gas and liquid films at the interface could be varied independently. The effects of changes of temp., alkali concn., and partial pressure of CO_2 were also studied. By considering the diffusion velocity through the double film, and the velocity of the chem. reaction, equations are obtained which are in good agreement with the exptl. results.

B. C. A.

Studies in the solubilities of the soluble electrolytes. I. Relationships between the temperature coefficients. ARTHUR F. SCOTT. *J. Phys. Chem.* 33, 1000-14(1929).—In this preliminary study of the soly. of the sol. electrolytes certain relationships between the temp. coeffs. of soly. are pointed out and an attempt is made to explain them. The procedure involves a study of the curves obtained when the solubilities of a series of salts with the same dominant ion are plotted against the soly. of one of the salts at corresponding temps.

Influence [of alkali and alkaline-earth halides] on solubility. W. HERZ AND F. HIEBENTHAL. *Z. anorg. allgem. Chem.* 177, 363-80(1928).—The effect of the halides of alkali and alk. earth metals on the soly. of K_2CrO_4 , $KMnO_4$, phenol, HgO , $K_2Cr_2O_7$, I and several org. acids was detd. With the 3 K salts the reverse effect was also investigated. The salts were added in varying concns. In most cases it was possible to represent the change in soly. by a simple linear equation, but sometimes the relationship was logarithmic in form. The effect on the soly. depends to a certain extent on the at. wt. of the added cation.

The solubility of the phosphates of calcium in aqueous solutions of sulfur dioxide. W. M. MEBANE, J. T. DOBBINS AND F. K. CAMERON. *J. Phys. Chem.* 33, 961-9(1929).—Soly. isotherms for Ca phosphates in aq. solns. of SO_2 were detd. and compared with the loci for hypothetical solns. of CaH_2PO_4 and $CaH_4(PO_4)_2$. The failure of previous investigators to develop a procedure for making superphosphate is explained.

Solubility of tin and some tin-copper alloys in acids. M. TZENTNERSHVER. *Z. physik. Chem., Abt. A*, 141, 167-79(1929).—With the exception of HNO_3 , Sn is fairly indifferent to strong mineral acids. The soly. of Sn in HCl was investigated according to methods previously outlined for Zn and Cd (*C. A.* 8, 2834; 23, 558). Sn dissolves in HCl only when the concn. is greater than 6 N. Data are tabulated showing that this soln. is a chem. process of the 4th order: (1) $Sn + 4Cl^{--} = SnCl_4^{--} + 2(-)$, (2) $2(-) + 2H^+ = 2H$, (3) $2H = H_2$; diffusion only exerts a secondary influence on soly. while temp. has a decided influence. Addn. of Cu increases the soly. of Sn when there is a max. of 1% Cu. In Sn-Cu soln. only the Sn dissolved; Cu or a compd. of Sn with Cu remained behind; the speed of this latter soln. process is increased by stirring; soln. of Sn alone is not appreciably affected by stirring.

Studies on hydrazine: Solubility relations of hydrazine picrate and the equilibrium $N_2H_5^+ + NH_3 \rightleftharpoons NH_4^+ + N_2H_4$. E. C. GILBERT. *J. Phys. Chem.* 33, 1235-46(1929).—The soly. of hydrazine picrate was detd. in various salt solns. (NH_4Cl , NH_4Pic , $NaPic$, $NaNO_3$, N_2H_5Cl , $NaCl$) at 25° and 15°. There is a considerable variation in the soly. product const. for the salt (range of 1.95×10^{-4} to 5.47×10^{-4} at 20°; 1.38×10^{-4} to 3.24×10^{-4} at 15°). Hydrazine was detd. by adding excess iodic acid and titrating with thiosulfate. Picric acid did not interfere. The const. for the equil. $N_2H_5^+ + NH_3 \rightleftharpoons NH_4^+ + N_2H_4$ is about 5.7×10^{-9} (av.). This corresponds to a dissoc. const. of ca. 1.5×10^{-6} for hydrazine in solns. of ionic strength 0.07-0.125. The solubilities of hydrazine picrate, tripropylamine picrate and dimethyltetraminecobaltic picrate also show considerable deviation from the law of constancy of the ion product where the solvents contained a common ion. The phenomenon is attributed to a sp. effect of the picrate ion.

Metallic diffusion. A. E. VAN ARKEL. *Metall-Wirtschaft* 7, 656-7(1928); *Chem. Zentr.* 1928, II, 334.—Detns. of the change in elec. cond. of a Cu wire coated with Ni, and of a Ni wire coated with Cu, kept at 800°, gave a diffusion const. of 5×10^{-11} .

Measurements of the vapor pressures of concentrated aqueous solutions of potassium iodide. NOBORU FURUTANI. *Mem. Coll. Science, Kyoto Imp. Univ. Ser. A* 11, 149-62(1928).—The vapor pressures of the concd. aq. solns. of KI were measured at various concns. The heats of vaporization were calcd. and it was noted that the values for C in the Clapeyron-Clausius equation vary with the concn. The soly. of KI at high temps. was calcd. (detd. graphically) from the data of the vapor pressures. The activities of the solvent were calcd. from the equation $a = (P/P_0)$ where P and P_0 are the vapor pressures of the soln. and the solvent, resp.

Vapor pressures of aqueous solutions of potassium iodide and sodium bromide at 25°. J. N. PEARCE, M. D. TAYLOR AND R. M. BARTLETT. *J. Am. Chem. Soc.* 50, 2951-8(1928).—The above vapor pressures were measured up to satn. by the method previously described (Pearce and Snow, *C. A.* 21, 1575). The osmotic pressures of the solns. calcd. by Fraser's formula deviate from those obtained by Lewis' expression above 0.8 M. Other thermodynamic properties of the solns. are calcd. also.

The viscosity of glycerol solutions. L. V. COCKS. *J. Soc. Chem. Ind.* 48, 279-80T

(1929).—A table of viscosities of glycerol solns. from 10% to 99.2% over a temp. range from 10° to 100° at 10° intervals is given. Small quantities of soap (Na oleate), 0.1% and 0.5%, increase the viscosity to the same extent as the addn. of 3.6% and 7.4% of glycerol to the 80% soln. At higher concns. of glycerol the effect of the small soap addns. is less marked.

E. G. R. ARDAGH

Electrolytic solution tension and the ionic state. V. Calculation of electrolytic solution tension. Mechanism of electrolytic dissociation. Nature of the ionic state. K. FREDENHAGEN. *Z. physik. Chem.* 140, 435-74 (1929); cf. C. A. 22, 2700; 23, 2344. — A theoretical discussion of the causes of electrolytic dissocn. and of the nature of the ionic state. The thermodynamic treatment of electrolytic soln forces given in the previous papers is summarized and a mechanism of electrolytic dissocn. is put forward. If KA represents a mol. of the solvent, then the chem. affinities of the two components K and A are not completely satd. by their union to form a mol. The mol. KA will be partly dissocd. into its constituents K and A , each of which will have a certain affinity for the dissolved substance and thereby decrease its chem. "activity." The soln. tension of a substance depends on the difference of its affinities for the 2 constituents K and A , becoming zero when they are equal, and is therefore a function of the internal forces in the solvent mol. The experimentally detd. electrolytic soln. tensions are of the order of magnitude required by the preceding assumptions. Further evidence for the theory is obtained from a consideration of the potential series of the elements in various solvents, of the dissocn. of water and molten salts, and of the variation of soln. tension and dissocn. with the temp.

B. C. A.

Activity coefficients of cadmium chloride and bromide. WALTER W. LUCASSE. *J. Am. Chem. Soc.* 51, 2597-2604 (1929).—Activity coeffs. at 25° were detd. by means of the cell, $Hg, Cd | CdX_2 | AgX | Ag$ for $CdCl_2$ from 0.01-6 M and for $CdBr_2$ from 0.01 to 3 M . The results are expressed by the equation $\log \gamma = \alpha m - \beta m^2$; the consts. α, β, α' for $CdCl_2$ are 0.6, 1.75, 0.38 and for $CdBr_2$ are 0.2, 1.48, and 0.308, resp. The curve for $CdCl_2$ falls much below the limiting function of Debye and Hückel for divalent salts and shows no min. as others do.

ARTHUR FLEISCHER

Activity coefficients of electrolytes. III. The principle of specific interaction in mixtures of high-valence electrolytes. VICTOR K. LAMER AND R. GRAHAM COOK. *J. Am. Chem. Soc.* 51, 2622-32 (1929); cf. C. A. 21, 1046. — The solubilities of $Co(NH_3)_6[Co(NH_3)_2(NO_2)_4]_b$, $Co(NH_3)_6[Co(NH_3)_2(NO_2)_2C_2O_4]_b$, $Co(NH_3)_6FeC_6N_6$ and $Co(NH_3)_6CoC_6N_6$ were measured at 25° in 0.1 N salt solns. The previous results of Lamer and Mason on the solubilities of the cobaltates in dil. K_2SO_4 solns. were checked. The numerical comparisons of the principle of sp. interaction can only be made when the ratios of the ionic strength as well as the equiv. concns. remain const. The principle of sp. interaction retains its validity in spite of the failure of the Debye limiting law at very low concns.

ARTHUR FLEISCHER

Activity coefficients of electrolytes. IV. The solubilities of lanthanum and thallous iodates in aqueous salt solutions and the principle of specific interaction. VICTOR K. LAMER AND FREDERICK H. GOLDMAN. *J. Am. Chem. Soc.* 51, 2632-45 (1929).—The solubilities of $La(IO_3)_3$ and $TlIO_3$ were measured at 25° for various valence types of salt solns. The soly. of $La(IO_3)_3$ in K_2SO_4 solns. shows the same abnormal variations from the Debye limiting law as was found for the cobaltamines. The data are in excellent agreement with the principle of sp. interaction, although the ratios do not agree with the theoretically calcd.

ARTHUR FLEISCHER

The general dilution law and the mechanism of electrolytic dissociation. V. TRET'YAKOV. *Z. Elektrochem.* 35, 440-51 (1929).—Assocn. of solvent mols. is assumed, followed by interaction of assocd. mols. with electrolyte to yield assocd. (solvated) ions. Only the undissocd. (free) ions take part in the original equil. with undissocd. electrolyte. If F = concn. of free ions, α = degree of dissocn. detd. by cond., D = dielec. const. of the solvent v_1 = vol. of pure solvent, v = vol. of soln., m = no. of ions into which electrolyte ionizes and n = the valence, $F = \frac{a}{\sqrt{1 + (nD/v_1)a^{2m/2n}}}$, and

$F^2/(1-F)^2 = \frac{a}{(1 + (nD/v_1)a^{2m/2n} - a\sqrt{1 + (nD/v_1)a^{2m/2n}})}$ const. This equation, tested against numerous aq. and non-aq. solns., is as accurate as the Ostwald and Rudolphi equations, and is more accurate if due allowance is made for the definition of terms.

A. P. SACHS

Boiling-point diagrams for binary high boiling point liquid mixtures. E. KORDES AND F. RAAZ. *Z. anorg. allgem. Chem.* 181, 225-36 (1929).—The detn. of the b. ps. of high-melting mixts. by the spiral method originally used by Ruff and co-workers

has been extended to a study of binary high-boiling liquid systems. The spiral method consists of a closed oven in which is suspended by means of a spiral spring, a small crucible contg. the substance to be studied. When the vapor pressure of the substance being studied becomes perceptible, the loss in weight of the contents of the crucible causes a contraction of the spring, the movement of which is detected by means of a suitable pointer. The oven is filled with an inert gas under const. pressure during the operation. The oven is heated at a const. rate, so that it is possible to correlate the loss in weight of the crucible with the time. The temp. may be observed either with an optical pyrometer or with a thermocouple. The b.-p. curves of the systems Hg, Cd and KCl-NaCl were detd., and the corresponding vapor pressure curves calcd. by means of the b.-p. curves and the vapor pressure of the pure components. The av. b. p. by the spiral method was 1430° for NaCl, 1411° for KCl, $359 \pm 5^\circ$ for Hg and $764 \pm 2^\circ$ for Cd. L. I. Q.

Applicability of dilute solution measurements in the determination of dipole moments. OTTO WERNER. *Z. physik. Chem., Abt. B*, **4**, 312 (1929). A crit. discussion of the well-known methods of resolving the total polarization into its constituent parts, arising from electronic and at deformation and mol. orientation, resp. The polarization-concn. curve for tetraisoamylammonium picrate in benzene up to mol. fractions of 4.6×10^{-4} of the salt was experimentally detd. by the short wave resonance method. The curve is not linear. The curve for very dil. solns. is interpreted to indicate ionic disson.; then follows a steep portion ascribed to undissoc. single mols., followed by a less steep portion indicating assocn. An estn. of elec. moment is not possible in such a case. W. WEST

Measurements of ultrasonic velocities in liquids. R. W. BOYLE, I. F. LEHMANN, AND S. C. MORGAN. *Trans. Roy. Soc. Can.* [3], **22**, Sect. 3, 371 (1928). The velocity of ultrasonic waves in liquids was detd. by the method of stationary waves. The exptl. work was carried out in a tube of large diam. both in a vertical and horizontal position, and using a moderate quantity of liquid. Changes in velocity with changing concn. were measured for NaCl soln. at 17° and the change of velocity with temp. over the range 0° to 20° was measured for H_2O and for a soln. of NaCl of sp. gr. 1.025. The velocity in both cases increased with rise in temp. J. W. SHIPLEY

The boiling points of glycerol solutions. C. E. HARVEY. *Pharm. J.* **122**, 516, 415 (1929).—A table is given calcd. by von Mayer Bugstrom (*C. A.* **18**, 3501), stating the b. p. of glycerol- H_2O mixts. at 40–760 mm. pressures (50 mm. intervals between 100 and 700 mm.) for mixts. contg. 0 to 100% glycerol at 10° intervals. S. W.

The distribution of strong bases and strong acids in saturated water solutions. V. I. NIKOLAEV. *Z. anorg. allgem. Chem.* **181**, 249 (1929). A crit. study of the quaternary systems $Na_2O-N_2O_5-H_2Cl_2-H_2O$, $K_2O-N_2O_5-H_2Cl_2-H_2O$, and $Na_2O-K_2O-N_2O_5-H_2O$; $Na_2O-K_2O-H_2Cl_2-H_2O$ from the viewpoint of the phase rule and thermodynamics. The study of these systems required a knowledge of the systems NaCl- $NaNO_3-H_2O$; NaCl- $NaNO_3-NaOH-H_2O$; NaCl- $NaNO_3-HCl-HNO_3-H_2O$; $Na_2O-N_2O_5-H_2O$; $Na_2O-H_2Cl_2-H_2O$; $K_2O-N_2O_5-H_2O$, and $K_2O-H_2Cl_2-H_2O$. Phase rule diagrams and tables are given. The influence of the heats of neutralization, diln. and hydration upon the compds. formed is discussed briefly. At higher temps. HNO_3 seems to exert a greater tendency toward combining with the bases than does HCl. There also seems to be a direct relation between the quantity of HNO_3 present and the decrease in soly. of the 2 nitrates, $NaNO_3$ and KNO_3 . L. I. Q.

Hydrolysis measurements with beryllium salt solutions. MILDA PRYTZ. *Z. anorg. allgem. Chem.* **180**, 355 (1929).—A series of measurements made by titrating $BeSO_4$ and $BeCl_2$ with 1 M NaOH potentiometrically indicated that the hydrolysis proceeds in stages with the successive formation of $Be(OH)^+$, $Be_2(OH)_2^{++}$ and Be_3O^{++} . No ppt. appears until more than 1 equiv. of NaOH is added. The ppt. has the compn. $Be_3O_2H_2$. In the chloride expts. the turning point of the titration curves coincides exactly with the second equiv. point and pure hydroxide ppts. In the sulfate expts., however, this was not the case and the ppt. contained sulfate. Back titrations with 0.5 M H_2SO_4 gave good reproducible potentials. L. T. FAIRHALL

The transference numbers of cadmium chloride and bromide. WALTER W. LUCASSE. *J. Am. Chem. Soc.* **51**, 2605 (1929).—From the previously detd. activity coeffs. and the measurements of e. m. f. of cells $Ag | AgX | CdX_2 (0.1 M) | CdX_2 (m) | - AgX | Ag$ the transference numbers for $CdCl_2$ from 0.01 to 6 M and for $CdBr_2$ from 0.01 to 3 M were detd. at 25° . For dil. solns. of $CdCl_2$ the transference no. is 0.486; the value decreases with increasing concn. and is neg. above 4.227 M. For $CdBr_2$ the value is 0.434 in dil. soln. and becomes neg. above 1.314 M. A. F.

Method of conductivity determination. OTTO REDLICH. *Z. physik. Chem.* **136**,

331-52(1928).—An a.-c. compensation method has been developed for the measurement of the cond. of solns. of electrolytes with uncoated electrodes. It is said that the error is about 0.02%. B. C. A.

The electric conductivity of salt vapors. HUGO QUERENGÄSSER. *Z. Elektrochem.* 35, 199-206, 459(1929).—The elec. conductivities of salt vapors have been measured in "vacuo." Several types of cell used gave inconsistent results. A cell has been devised which gives satisfactory results; its details are shown in a self-explanatory cut.

ALBERT L. HENNE

The "water correction" in the measurement of the electrical conductivity of very dilute aqueous solutions of electrolytes. I. M. KOLTHOFF. *Rec. trav. chim.* 48, 664-80(1929). In many cases, particularly the measurement of the cond. of dil. solns. of neutral salts and strong acids, equil. water may be used if it is in equil. with the atm. at the temp. at which the measurement is made and if it is certain that CO_2 is the only impurity of electrolytic character. A "water correction" may be used when measuring the cond. of strong acids, neutral salts and weak acids. For similar measurements of the salts of weak bases and strong acids, salts of weak acids and strong bases, and of bases, the computation of the "water correction" becomes difficult and inexact; in these cases the use of pure water is to be recommended. When measuring the cond. of extremely dil. alk. solns., it is necessary to work with pure water, under conditions permitting no contamination with CO_2 from the air. The glass of the cell must be protected from the action of the OH ion and blank Pt electrodes must be used. Platinized electrodes adsorb the OH ion strongly. It is shown that the work of Remy and Kuhlman on the cond. of dil. solns. of HCl and KOH and the soly. of slightly sol. oxides is unreliable.

DON BROUSE

The measurement of conductivities by means of oscillating circuits. S. D. GEHMAN and B. B. WEATHERBY. *Phil. Mag.* 17, 7, 567-9(1929).—A criticism of the conclusion of Burton and Pitt of *C. A.* 22, 3089. The authors suggest that the effects, reported by Burton and Pitt, are to be ascribed to the dielec. consts. of the liquids used. A comparison of the dielectric consts. with the dielec. const. is given to show the parallelism.

L. H. REYERSON

The law of equilibrium and conductivity of electrolytes. K. JABLONSKI. *Russ.-ski Chem.* 8, 22-30. *Chem. Zentr.* 1928, II, 428; cf. *C. A.* 23, 3390. —The law of mass action for electrolytes is adduced in which the ion concn. (N) is expressed as the $1/4$ power. The equation satisfies the equil. established by KCl, KBr, KI, KCNS, RbCl, RbBr, RbI, CsCl, NH_4Cl , NH_4Br , NH_4I and NH_4CNS . For Li, 11 H_2O is assumed while 3 H_2O is taken for the hydration of Na. The equil. const. (K) = $K_\infty - AN^{1/4}$. For cond., $\lambda = (\text{unlimited diln.})$, $d = 1/\lambda \propto 1/K$, where $d = \text{const.}$ By using this formula, a good degree of accuracy is obtained for higher dilns. of electrolytes. C. R. F.

Shapes and figures of microscopic drops during equilibrium conditions caused by diffusion. N. A. RASHEVSKY. *Z. Physik* 56, 247-305(1929).—If a drop grows slowly by diffusion of certain materials from the outside to the inside, there will be established within the drop a definite quasi-stationary distribution of concn. If the drop is non-spherical then the concn. is different along the surface. The product of surface tension and concn. for every part of the surface is const. It is then conceivable that not only crystals would have a tendency to reproduce their shape but that also very complex, heterogeneous systems would tend to assume a definite shape after an initial disturbance. Cf. *C. A.* 23, 2627.

GEORGE GLOCKLER

Equilibrium between metals and salts in fusion mixtures. XVI. The influence of added chemicals upon the equilibrium and the preliminary calculation of the latter with the formulas of the new law of mass action. RICHARD LORENZ and GEORG SCHULZ. *Z. anorg. allgem. Chem.* 179, 97-110(1929); cf. *C. A.* 23, 4390. —Addn. of inert material which does not participate in the reaction, e. g., $\text{Cd} + \text{PbCl}_2 \rightleftharpoons \text{Pb} + \text{CdCl}_2$, causes a shift of the equil. from left to right when a salt ($\text{NaCl} + \text{KCl}$) is added to the salt phase and from right to left when a metal (Sb) is added to the metal phase. A limit is reached after a definite quantity has been added. The exptl. results are discussed on the basis of the new law of mass action.

EMIL KLARMANN

Equilibrium between metals and salts in fusion mixtures. XVII. The equilibrium between calcium and sodium and their chlorides. R. LORENZ and R. WINZER. *Z. anorg. allgem. Chem.* 181, 193-202(1929); cf. preceding abstract.—The conditions for equil. for the reaction $\text{Ca} + 2\text{NaCl} \rightleftharpoons 2\text{Na} + \text{CaCl}_2$ were detd. The reaction was studied from both sides. From the practical viewpoint the use of either Na metal or CaCl_2 served the same purpose in studying the equil. There is a miscibility gap in the curve in the region from 16 to 98.5% CaCl_2 . The temp. apparently had no effect.

No variations other than those due to analytical sources of error could be detected for a temp. interval of over 300°.

L. L. Q.

Conductivity measurements with hydrocarbons and halogenated hydrocarbons. HERMANN GLOY. *Dissertation Rostock 1927*, 39 pp.; *Physik. Ber.* 9, 1082(1928).—Cond. measurements were made of solns. of tetraisoamylammonium picrate, iodide, thiocyanate and perchlorate in benzene, toluene (at 72°), pentachloroethane, trichloroethylene, dichloroethylene and tetrachloroethane (at 25°) and of triisoamylammonium picrate, iodide and dimethylpyrone picrate in dichloroethylene as well as AgClO_4 in benzene and toluene. Uhlich's method of measurement was used. Densities and viscosities were detd. The Kohlrausch, Debye, Hückel square root expression gave $V = 90,000$ (approx.) for dichloroethylene and $V = 40,000$ for tetrachloroethane. These values were used for extrapolation. Walden's $d\eta$ formula gave low values for λ_∞ . The Walden equation $\lambda_\infty \eta_\infty = k$ gave good results for dichloroethylene and tetrachloroethane. The following ion mobilities were thus calcd.:

Ions	Dichloroethylene $\eta = 0.004364$		Tetrachloroethane $\eta = 0.01612$	
	λ	$\lambda\eta$	λ	$\lambda\eta$
$\text{N}(\text{C}_5\text{H}_{11})_4$	33.15	0.145	8.50	0.136
Picrate	61.85	0.270	16.75	0.270
Iodide	69.35	0.303	18.7	0.302
Thiocyanate	78.35	0.342	20.5	0.331
Perchlorate	89.85	0.392	24.0	0.387

ALBERT L. HENNE

Heat conductivity of ice. S. ARZIBISHEV AND I. PARFANOVICH. *Z. Physik* 56, 441-5(1929).—The heat cond. of ice is $(55 \pm 8) \times 10^{-4}$ cal./cm.

G. G.

An improved form of the quinhydrone electrode. GLENN E. CULLEN. *J. Biol. Chem.* 83, 535-8(1929); cf. *C. A.* 19, 3101.—The simple quinhydrone microelectrode of Cullen and Biilmann has been so modified that it is easy to prep. and standardize a large no. of the electrodes because of their simplicity and cheapness. Thin capillary tubing is used so that temp. equil. in the KCl vessel is obtained almost immediately and only 0.3 to 0.5 cc. of soln. is required for a detn. All errors due to loss of CO_2 are eliminated. De Khotinsky cement was very unsatisfactory, especially at 38°, and its use is no longer necessary in the new form.

A. P. LOTHROP

The potential of the nickel electrode. M. M. HARING AND E. G. VANDEN BOSCH. *J. Phys. Chem.* 33, 161-78(1929).—A crit. study of the factors contributing to lack of reproducibility of the value of the single potential of Ni was made. By using a method of fractional electrolysis, impurities such as Cu and H₂ were simultaneously removed. The cell $\text{Ni} + \text{Hg}_2\text{SO}_4 \rightleftharpoons \text{NiSO}_4 + 2\text{Hg}$ was used in this investigation, for which E may be deduced from the equation $E = E_0 \times 0.05912 \log \gamma_m$ is a_\pm , the mean activity coeff. of Ni and SO_4 ions, estd. from comparable activity data on CuSO_4 solns. Very good agreement was obtained for E_0 values which ranged only from 0.851 to 0.853 v. with NiSO_4 prepd. from (1) thrice recrystd. NiSO_4 (2) electrolyzed Ni, and (3) Mond Ni. The value finally given for the standard Ni electrode is 0.231 v. \pm 0.002 at 25°. The technic would seem to emphasize the necessity of excluding O_2 and H_2 in the potential measurements.

H. R. MOORE

The etymology of the word "gas." MAX SPETER. *Chem.-Zig.* 53, 701(1929).

E. J. C.

The anomaly observed in the diamagnetism of gases. AUGUST GLASER. *Ann. Physik* [5], 1, 814-20(1929).—The diamagnetic susceptibilities of A and Ne at various pressures between 5 mm. and 760 mm. were measured by the method previously used. (cf. *C. A.* 19, 2295; 20, 1350). CO_2 was used as the reference gas in terms of the susceptibility of which the actual values for A and Ne were calcd. Special precautions were taken to insure purity of the test gases and the values for the vol. susceptibilities, viz. 80.5×10^{-11} for A and 27.4×10^{-11} for Ne, are in good agreement with those obtained by Hector by direct measurement (cf. *C. A.* 19, 599). Neither A nor Ne showed the anomaly previously observed in the polyatomic gases studied. Hammar's suggestion that the anomaly might be due to traces of moisture (cf. *C. A.* 21, 356-7) was tested for A but the results were neg. G. emphasizes the point that these differences in behavior between the monatomic and the polyatomic gases indicate that the explanation must be sought in the at. character of the gases. *Ibid* [5], 2, 233-48.—Previous expts. indicated that for CO_2 , CO, H₂ and N₂ the diamagnetic susceptibility at low pressures is not a linear function of the pressure, although it is at higher pressures. These results were not confirmed by Lahrer nor by Hammar and H. offered a possible explanation of G.'s results (cf. *C. A.* 21, 356-7). G. now gives details of measurements

on CO_2 and A, both pure and when mixed with small proportions of O_2 . For A and mixts. of A with O_2 , the susceptibility is a linear function of the pressure for all values up to 76 cm. For a given pressure, the numerical value of the susceptibility decreases slightly with increase of O_2 . Pure CO_2 shows the anomaly previously observed for pressures below 350 mm. A mixt. contg. 1% O_2 by vol. gives a linear relation between susceptibility and pressure, while for higher percentages of O_2 the anomaly is reversed and the initial susceptibility corresponds to that of the O_2 in the mixt. E. g., a mixt. contg. 2% O_2 is paramagnetic for pressures below 180 mm., while a mixt. contg. 1.2% O_2 is paramagnetic at all pressures. To guard against possible errors due to diffusion, expts. were made starting both at low pressures and at atm. pressure. G. insists on the reality of the anomaly observed in CO_2 and suggests that Hammar's results may have been due to traces of O_2 introduced in the course of his expts. W. W. STIFLER

Addendum to "the reaction of activated mercury with oxygen." A. I. LEIPUNSKII AND A. V. SAGULIN. *Z. physik. Chem.*, Abt. B, 3, 215-6(1929); cf. C. A. 23, 1054.—Tables of data to accompany the earlier paper are given. R. L. DODGE

Determination of the kinetics of rapid reaction systems. H. SCHMID. *Z. physik. Chem.*, Abt. A, 141, 41 51(1929).—A method for the detn. of chem. kinetics in rapid reaction systems was developed which combines the process of Hartridge and Roughton (C. A. 18, 190) for measuring velocity of reaction with customary precautions of stopping reaction and which has wide application in detg. kinetics of rapid complicated reactions. An example was made of the decompn. of HNO_2 within a time interval of less than 1 sec., showing that the method yields very exact results. The app. used is illustrated. M. McMAHON

The kinetics of the reaction $2\text{NO} + \text{O}_2 = 2\text{NO}_2$ at low pressures and under the influence of strong magnetic fields. G. KORNFIELD AND E. KLINGLER. *Z. physik. Chem.*, Abt. B, 4, 37-66(1929).—The reaction $2\text{NO} + \text{O}_2 = 2\text{NO}_2$ is trimolecular, $dx/dt = k \cdot p[\text{O}_2] \cdot p^2[\text{NO}]$. The value of the const. k is between 2.8 and 3.3×10^4 . If $\text{C}_{10}\text{H}_7\text{Br}$ were used instead of Hg as manometer liquid the value of k would be 5.9×10^8 which is in good agreement with the value detd. by Bodenstein. The influence of a magnetic field on the rate of reaction could not be definitely detd. O. A. NELSON

Theoretical foundation of the kinetic theory of gases. V. GLUMAC. *Z. Physik* 56, 432-4(1929).—The gas laws are derived from hydrodynamical theory. G. G.

The kinetics of the hydrolysis of certain glucosides. II. Trehalose, α -methylglucoside and tetramethyl- α -methylglucoside. JEMIR A. MORLWYN-HUGHES. *Trans. Faraday Soc.* 25, 81-92(1929); cf. C. A. 22, 1888.—The velocities of the hydrolysis of trehalose, α -methylglucoside and tetramethyl- α -methylglucoside in N HCl were detd. polarimetrically at two different temps. Since the ratio of the rates of hydrolysis of two glucosides differs with temp., the crit. increment of the hydrolysis forms a more reliable basis for comparison of structural stability. Since trehalose is a very stable glucoside, and has the grouping $-\text{O.C.O.C.O}-$ present in sucrose, the extreme instability of sucrose toward hydrolysis cannot be ascribed to this group. It is believed that this instability is due rather to the presence of a γ -fructose residue in sucrose, and that the first step in hydrolysis of all glucosides is the rupture of the oxide ring. Since the temps. are close together at which the hydrolyses of glucosides and of γ -butyrolactone take place at unit rate, and since the corresponding temps. diverge for the mutarotation of glucose and the hydrolysis of γ -butyrolactone, it is believed that mutarotation does not involve fission of the oxide ring. In enzymic hydrolysis, it is believed that the function of the enzyme is to allow certain internal degrees of freedom of the substrate mol. to contribute to the total energy of activation. M. W. S.

The possibility of characterizing kinetic processes in heterogeneous systems by uniform stirring conditions. WITALI HELLER. *Z. physik. Chem.*, Abt. A, 142, 431-52(1929).—See C. A. 23, 1804. R. H. FERGUSON

Types of unimolecular reactions. OSCAR K. RICE. *Proc. Nat. Acad. Sci.* 15, 459-62(1929).—Some simple chem. reactions have already been explained on the basis of the quantum mech. resonance phenomenon (cf. Oppenheimer, C. A. 22, 3354; Kallmann and London, C. A. 23, 3399; Langer, *Phys. Rev.* 33, 290(1929)). There are pointed out relations between certain reactions, one of which has been considered on the basis of quantum mechanics and the others of which have been treated only by classical or old quantum theory methods. These relations may later permit new inferences about the more complicated reactions. The 3 types considered are predissocn., unimol. decompn. of complex org. compds. and photochem. decompn. of the same compds., all occurring in the gaseous state. R. L. DODGE

The rate of decomposition of nitrogen pentoxide at moderately low pressures. H. C. RAMSPERGER, M. E. NORDBERG AND R. C. TOLMAN. *Proc. Nat. Acad. Sci.* 15,

453-9(1929).—Possible errors in earlier measurements of the rate of decomps. of gaseous N_2O_5 at low initial pressures are indicated. The rate was re-measured at initial pressures between 0.190 and 2.044 mm. and temps. between 30° and 42° , by a method designed to eliminate these errors. The results agree with those obtained at high pressure by Daniels and Johnston (*C. A.* 15, 976), within the exptl. error of either piece of work. Down to 0.2 mm., N_2O_5 shows no change in its specific first-order rate of decomps. R. L. DODGE

Thermal decomposition of methane. I. Decomposition in silica bulbs. G. C. HOLLIDAY AND H. C. EXELL. *J. Chem. Soc.* 1929, 1066-74. —The dissocn. of CH_4 at various pressures and temps. up to 1200° was studied. All results suggest a reaction approaching equil. but bearing no relation to the true reversible equil. The apparent equilibria are possibly due to the deposition of a hydrocarbon possessing a vapor pressure greater than that of C or to the retardation of the reaction by selective adsorption. Ni deposited on the inside of the equil. bulb increased the velocity of the reaction enormously. C_2H_2 decomposed giving the same equil. mixt. of CH_4 and H_2 . The temp. effect on the const. pCH_4/pH_2 was found the same as that for a true equilibria. J. W. SHIPLEY

Splitting of organic compounds by catalytic hydrogenation over nickel. The role of the catalyst in heterogeneous catalysis. A. A. BAXANDY. *Z. physik. Chem., Abt. B*, 3, 167-94(1929); cf. *C. A.* 23, 2872. —On the basis of available data on the hydrogenation of org. compds over Ni it is shown that the groups which split off can be arranged in a perfectly definite series, the ease of splitting increasing as one goes up the series. The ease of splitting of the groups from the mol. is greater, the greater the affinity of the group for the catalyst, and the less their affinity for one another in the mol. The action of the catalyst is connected with its tendency to decrease the stability of the group. R. L. DODGE

Heterogeneous decomposition reactions. H. DOHSE AND W. KALHERER. *Z. physik. Chem., Abt. B*, 5, 131-55(1929). —The kinetics of alc. decomps. in the presence of bauxite was shown to be that of a continuous breaking down process of a surface layer. The heat of activation amounts to 30,000 cal. Isotherms of H_2O , propylene, and alc. with bauxite were measured in the vicinity of the reaction temp. The decomps. of the adsorbed layer of isopropyl alc. was directly measured and found to be monomol. The const. is independent of the adsorbed mass for small film thicknesses. In such a case the heat of activation amounts to 25,500 cal. because water is not desorbed. L. T. F.

Irreversible transformations of organic compounds under high pressures. (Preliminary paper.) P. W. BRIDGMAN AND J. B. CONANT. *Proc. Nat. Acad. Sci.* 15, 680-3(1929); cf. *C. A.* 20, 2611. —Org. compds. were subjected to pressures as high as 12,000 atm. at room temp. Some, including amylene, were unaffected, but isoprene, dimethylbutadiene, styrene and indene were more or less completely polymerized to solids. The polymerization of butyraldehyde was largely reversible. Impurities affected the rate of polymerization of isoprene. Carboxyhemoglobin was pptd., the rate depending on the pH of the soln. T. H. CHILTON

Oxidative action of chloramine-T and its stability in the solid and liquid condition. R. DIETZEL, K. TAUFEL AND H. REBER. *Apoll. Ztg.* 44, 989-93, 1007-9(1929). —A study was made of various conditions under which hydrolysis of chloramine-T is effected, and of the isolation and identification of the resulting products, notably when aq. solns. of chloramine are exposed to sunlight and to ultra violet rays. The cryoscopic behavior of this substance has likewise been observed, and the results are tabulated. W. O. E.

Note on the reaction velocity between iodide and persulfate ions. W. OOSTEREN. *Rec. trav. chim.* 48, 697(1929). —Brief notes in support of the views of King and Jette (cf. *C. A.* 23, 2870) on the iodide-persulfate reaction. DON BROUSE

Homogeneous catalysis. NICHOLAS A. MILAS. *Proc. Nat. Acad. Sci.* 15, 506-601(1929). —It is shown that anthraquinone acts as a true negative catalyst in the oxidation of anethole by O_2 . The catalyst was recovered quant. either by the concd. H_2SO_4 method or by the Zn dust-KOH method. The plot of the O_2 absorption in 1/mol. hr. against time rises rapidly to a max. (V_m) and then falls off. The empirical equation $k = V_m C^{1/2}/t$ holds for the reaction. k is 0.02075, C is concn. of inhibitor in mols./mol. anethole, and t is time in min. Benzoquinone was also investigated and found to be a more active inhibitor. The same type of curve was obtained. $k = 0.00377$ for benzoquinone. The fact that the concn. of inhibitor appears in the equation in the $1/2$ power is explained on the ground that in quinone complexes there is one mol. of quinone to two mols. of the other constituents. M. emphasizes the importance of

the max. O_2 absorption rate as one of the most characteristic properties in all autoxidation phenomena.

WILLIAM E. VAUGHAN

The action of iron catalysts on mixtures of carbon monoxide and hydrogen. ÉTIENNE AUDIBERT AND ANDRÉ RAINEAU. *Ind. Eng. Chem.* 21, 880-5(1929).—See C. A. 23, 2094, 3620.

E. H.

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453-9(1929).—Possible errors in earlier measurements of the rate of decompns. of gaseous N_2O_5 at low initial pressures are indicated. The rate was re-measured at initial pressures between 0.190 and 2.044 mm. and temps. between 30° and 42°, by a method designed to eliminate these errors. The results agree with those obtained at high pressure by Daniels and Johnston (*C. A.* 15, 976), within the exptl. error of either piece of work. Down to 0.2 mm., N_2O_5 shows no change in its specific first-order rate of decompn. R. L. DODGE

Thermal decomposition of methane. I. Decomposition in silica bulbs. G. C. HOLLIDAY AND H. C. EXELL. *J. Chem. Soc.* 1929, 1066-74.—The disson. of CH_4 at various pressures and temps up to 1200° was studied. All results suggest a reaction approaching equil. but bearing no relation to the true reversible equil. The apparent equilibria are possibly due to the deposition of a hydrocarbon possessing a vapor pressure greater than that of C or to the retardation of the reaction by selective adsorption. Ni deposited on the inside of the equil. bulb increased the velocity of the reaction enormously. C_2H_6 decomposed giving the same equil. mixt. of CH_4 and H_2 . The temp. effect on the const. $p(CH_4)/p^2(H_2)$ was found the same as that for a true equilibria. J. W. SIMPLY

Splitting of organic compounds by catalytic hydrogenation over nickel. The role of the catalyst in heterogeneous catalysis. A. A. BIVANDIN. *Z. physik. Chem.*, Abt. B, 3, 167-94(1929); cf. *C. A.* 23, 2872. On the basis of available data on the hydrogenation of org. compds. over Ni it is shown that the groups which split off can be arranged in a perfectly definite series, the ease of splitting increasing as one goes up the series. The ease of splitting of the groups from the mol. is greater, the greater the affinity of the group for the catalyst, and the less their affinity for one another in the mol. The action of the catalyst is connected with its tendency to decrease the stability of the group. R. L. DODGE

Heterogeneous decomposition reactions. II. DOHLE AND W. KALBRECHT. *Z. physik. Chem.*, Abt. B, 5, 131-55(1929).—The kinetics of alc. decompn. in the presence of bauxite was shown to be that of a continuous breaking down process of a surface layer. The heat of activation amounts to 39,000 cal. Isotherms of H_2O , propylene, and alc. with bauxite were measured in the vicinity of the reaction temp. The decompn. of the adsorbed layer of isopropyl alc. was directly measured and found to be monomol. The const. is independent of the adsorbed mass for small film thicknesses. In such a case the heat of activation amounts to 25,500 cal. because water is not desorbed. L. T. F.

Irreversible transformations of organic compounds under high pressures. (Preliminary paper.) P. W. BRIDGMAN AND J. B. CONANT. *Proc. Nat. Acad. Sci.* 15, 680-3(1929); cf. *C. A.* 20, 2611.—Org. compds. were subjected to pressures as high as 12,000 atm. at room temp. Some, including amylene, were unaffected, but isoprene, dimethylbutadiene, styrene and indene were more or less completely polymerized to solids. The polymerization of butyraldehyde was largely reversible. Impurities affected the rate of polymerization of isoprene. Carboxyhemoglobin was pptd., the rate depending on the pH of the soln. T. H. CULLTON

Oxidative action of chloramine-T and its stability in the solid and liquid condition. R. DIETZEL, K. TAUFEL AND H. REDER. *Apoth. Ztg.* 44, 980-93, 1007-9(1929).—A study was made of various conditions under which hydrolysis of chloramine T is effected, and of the isolation and identification of the resulting products, notably when aq. solns. of chloramine are exposed to sunlight and to ultra violet rays. The cryoscopic behavior of this substance has likewise been observed, and the results are tabulated. W. O. E.

Note on the reaction velocity between iodide and persulfate ions. W. ØSTVÆN. *Rec. trav. chim.* 48, 697(1929).—Brief notes in support of the views of King and Jette (cf. *C. A.* 23, 2870) on the iodide-persulfate reaction. DON BROUSE

Homogeneous catalysis. NICHOLAS A. MILAS. *Proc. Nat. Acad. Sci.* 15, 596-601(1929).—It is shown that anthraquinone acts as a true negative catalyst in the oxidation of anethole by O_2 . The catalyst was recovered quant. either by the concd. H_2SO_4 method or by the Zn dust-KOH method. The plot of the O_2 absorption in l./mol. hr. against time rises rapidly to a max. (V_m) and then falls off. The empirical equation $k = V_m C^1/t$ holds for the reaction. k is 0.02075, C is concn. of inhibitor in mols./mol. anethole, and t is time in min. Benzoquinone was also investigated and found to be a more active inhibitor. The same type of curve was obtained. $k = 0.00377$ in the $1/2$ power is explained on the ground that in quinone complexes there is one mol. of quinone to two mols. of the other constituents. M. emphasizes the importance of

the max. O_2 absorption rate as one of the most characteristic properties in all autoxidation phenomena.

WILLIAM E. VAUGHAN

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not form a compd. The mol. depression per 100 g. of $\text{CO}(\text{NH}_2)_2$ is approx. 215 for dil. solns. In molten $\text{CO}(\text{NH}_2)_2$, NH_4NO_3 and CH_3CONH_2 are strongly assocd. For dil. solns. in molten NH_4NO_3 the mol. depression is about 221 per 100 g. $\text{CO}(\text{NH}_2)_2$, LiNO_3 and H_2O are all normal or nearly so in this solvent, but NaNO_3 and CH_3CONH_2 are slightly assocd. KNO_3 causes a subnormal depression of the f. p. partly because it seps. with the solvent in the form of mixed crystals $\text{Ca}(\text{NO}_3)_2$ is slightly assocd. and NH_4Cl strongly assocd. in molten NH_4NO_3 . J. W. SHIPLEY

Remarks in explanation of the orientation polarization observed in the case of Ca_4 derivatives. A. SCHLEEDER, G. JUNG AND A. HETTICH. Chem. Inst. Univ. Greifswald. *Z. physik. Chem.*, Abt. B, 3, 479-80 (1929); cf. Ebert, Eisenschitz and Hartel, *C. A.* 23, 318. —A preliminary discussion. L. F. AUDRIETH

Thermal dissociation of steam into hydrogen and free hydroxyl. K. F. BONDHOEFFER AND H. REICHARDT. *Z. Elektrochem.* 34, 652-4 (1928). —The absorption spectrum of steam contg. suitable amts. of O shows at 1200° the presence of free OH. The heat of the reaction $2\text{H}_2\text{O} = \text{H}_2 + 2\text{OH}$ is detd. as $-125,000$ g.-cal., or possibly higher at about 1400° . The equil. const. for this reaction, calcd. by Nernst's heat theorem are very close to those detd. experimentally for the reaction $2\text{H}_2\text{O} = 2\text{H}_2 + \text{O}_2$. B. C. A.

Calorimetric researches. XVIII. Some measurements on the two hydrobenzoins. P. H. VERKADE AND J. COOPS, JR. *Rec. trav. chim.* 48, 1031-4 (1929); cf. *C. A.* 3, 2095. —For the heat of combustion of the internally compensated hydrobenzoin (m. $135.5-6.5^\circ$) V and C (*C. A.* 22, 3330) found $Q_r = 1719.9$ Cal (15°) and $Q_p = 1721.3$ Cal (15°), exactly the same figures being obtained by Roth (private communication). For *d*- and *l*-isohydrobenzoin, m. $147.5-8.5^\circ$, prepd. by Ott (Univ. of Munster, Germany) by crystn. of synthetic isohydrobenzoin from ether at room temp. (Erlenmeyer, *Ber.* 30, 1531 (1897)) and mechanically picking out the crystals of both isomers, the following figures were obtained: for the *d*-compd. $Q_r = 1719.3$ Cal (15°); $Q_p = 1720.8$ Cal (15°) and for the *l*-compd. $Q_r = 1719.7$ Cal (15°), $Q_p = 1721.1$ Cal (15°); these values are not in agreement with $Q_p = 1724$ Cal (15°) found by Roth and Muller for *d*-isohydrobenzoin (private communication). The crystn. of *dl*-isohydrobenzoin from water or ether above $30-35^\circ$ does not give separate crystals of both isomerides but an intimate mixt., m. $118-119^\circ$, for which $Q_r = 1718.6$ Cal (15°) and $Q_p = 1720.0$ Cal (15°) were found, again in excellent agreement with the value found by Roth and Muller (private communication). Mainly on crystallographic grounds, Ott accepts the existence of a *dl*-compd. of *d*- and *l*-isohydrobenzoin and the heats of combustion found by V. and C. for the substance m. $118-119^\circ$ and for the optically active compds. are in agreement with this view, the latter compds. giving a definitely higher value. For the heat of racemization Δ (*d-dl*) 1.0 Cal (15°) is calcd. from the figures of V. and C., while a value of about 4 Cal. (15°) is obtained from the measurements of R. and M. Hitherto the only heats of racemization which were known, are those of tartaric acid (2.1 Cal.); dimethylsuccinic acid (0.3 Cal.) and di-Me tartrate (1.0 Cal.) and the figure found by R. and M. is therefore so large that V. and C. are inclined to reject the heat of combustion found by R. and M., although in this respect caution should certainly be observed. The heats of combustion of the pairs *d*-tartaric and *meso*-tartaric acids; *d*-tartramide and *meso*-tartramide; *d*-tartaric and *meso*-tartaric diethylamide; *l*-dimethylsuccinic acid and *meso*-dimethylsuccinic acid lie very close together; except for the tartramides, the *meso*-form always has the greater energy content. The rule of Stohmann that the isomer with the highest m. p. always has the smallest heat of combustion is only obeyed in 2 cases, viz., with the tartaric acids and the diethylamides. The heats of combustion found for the several hydrobenzoins lie so close together that it cannot be decided on the basis of these data which of the 2 stereoisomers possesses the greater energy content; it is, of course, in harmony with expectation that the *d*- and *l*-isohydrobenzoin possess the same energy content. C. F. VAN DUIN

The equation of van der Waals and thermodynamics. J. E. VERSCHAFFELT. *Compt. rend.* 188, 1037-9 (1929); cf. *C. A.* 23, 3397. — Polemic with Vasilescu-Karpen (*C. A.* 23, 4117).

Maxwell-Clausius and Clapeyron relations. VASILESCU KARPEN. *Compt. rend.* 188, 778-9 (1929); cf. *C. A.* 23, 1792. —A generalization of the author's previous deductions in which the Maxwell-Clausius relation is shown to be obtainable for any fluid, independently of Carnot's principle by replacing the condition imposed by the latter by the condition of equil. between the liquid and the satd. vapor above it. B. C. A.

The entropy of hydrogen. WORTH H. RODEBUSH. *Proc. Nat. Acad. Sci.* 15, 678-80 (1929). —If thermal data were obtained on H actually in an equil. condition, it is likely that the entropy so calcd. would agree with that derived from chem. equil.

R. proposes an equation for the same purpose, which gives a value of 17.0 for the entropy of $1/2$ H_2 at $298^\circ K$. T. H. CHILTON

A general thermodynamical integrating factor of the entropy function. A. PRESS. *Z. Physik* 56, 131-46(1929); cf. *C. A.* 22, 533.—Mathematical. GEORGE GLOCKLER

Thermodynamic considerations of some interesting reactions. IVO BRICHTA. *Arch. chem. farm.* 3, 106-13(1929)—The Nernst theorem is applied to some organic reactions, in particular org. reactions. JAROSLAV KUČERA

Specific heats and vapor pressures of systems formed from water and the oxides of zirconium, thorium and tin. GUSTAV F. HÜTTIG, S. MAGIERKIEWICZ AND J. FICHMANN. *Z. physik. Chem., Abt. A*, 141, 1-34(1929).—Changes in such systems which are usually attributed to "ageing" may be followed by means of sp.-heat measurements. Measurements made with preps. of varying water content in the systems: ZrO_2-H_2O , ThO_2-H_2O and SnO_2-H_2O by the method of Hüttig and Wehling (*C. A.* 20, 3631) show that the relation between the sp. heat and the water content is given as a first approximation by $\log_e c_0/c = k/N$, where c_0 is the mol. heat of pure water, c is the mol. heat of the hydrate contg. N mols. of water to 1 mol. of oxide and k is an empirical const. Vapor-pressure measurements have also been made and a similar connection is found to hold between the vapor pressure and water content. The changes in the "ageing" process are discussed. B. C. A.

The thermochemistry of the compounds occurring in the system calcium oxide-alumina silica. I. The heat of solution of calcium oxide in hydrochloric acid. T. THORVALDSON, WELDON G. BROWN AND C. R. PEAKER. *J. Am. Chem. Soc.* 51, 2678-82(1929).—An av. of 14 detns. on 4 carefully purified samples of CaO for the heat of soln. of CaO in HCl 200H₂O at 20° gave a value of 46.50 Cal₂₅ per mol. The heat of soln. is not affected by varying the temp. of ignition of the CaO between 800° and 1200° . ARTHUR FLEISCHER

The structure of andalusite (TAYLOR) 8. The structure of staurolite (NÁRAY-SZABÓ) 8. The structure of cyanite (NÁRAY-SZABÓ, *et al.*) 8. A comparative x-ray study of some silicates (GOSSNER, MUSSGOTT) 8. Measurement of the effective wave length of screens used in pyrometry (MENDOUSSE) 3. Specific heats of mineral oils (HENDERSON, *et al.*) 22. The specific volume of white cast Fe (ZIMMERMANN, EßSER) 9.

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3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

S. C. LIND

Average life period of an atom. J. H. J. POOLE. *Nature* 123, 131(1929); cf. *C. A.* 23, 1808. W. WEST

The atom theory and chemical valences. E. HULTHÉN. *Teknisk Tidskrift* 59, Kemi 62 6(1929).—A brief review of late theories and investigations. G. R.

The peaceful penetration of atomism. EDGAR J. WITZEMANN. *Sci. Monthly* 1929, 363 8.—An essay. E. J. C.

The development of the most modern concepts concerning the structure of the atom based upon the fundamentals of quantum and wave mechanics. FRIEDRICH MÜLLER. *Metallbörse* 19, 1797 8, 1855-7(1929).—An attempt is made to present Heisenberg's quantum mechanics and Schrödinger's wave mechanics in a very simple form, shorn of much of the original mathematics. W. C. EBAUGH

Quantum of action and nature description. N. BOHR. *Naturwissenschaften* 17, 483 6(1929).—A review. B. J. C. VAN DER HORVEN

- The expression of quantum laws by continuous functions. H. SCHRÖDINGER. *Naturwissenschaften* 17, 486-9(1929).—A review. B. J. C. VAN DER HOEVEN
- The development of the quantum theory 1918-1928. W. HEISENBERG. *Naturwissenschaften* 17, 490-6(1929).—A historical review. B. J. C. VAN DER HOEVEN

enschaften 17, 498-507(1929).—A review

The significance of the quantum theory for chemistry. F. LONDON. *Naturwissenschaften* 17, 516-29(1929).—An extensive review dealing with the explanation of chem. bonds, valency and reaction kinetics from quantum mechanics. B. J. C. v. d. H.

The initial quantum theory of several degrees of freedom. A. SOMMERFELD. *Naturwissenschaften* 17, 481-3(1929).—A review. B. J. C. VAN DER HOEVEN

The quantum theory of valency. W. HEITLER. *Naturwissenschaften* 17, 516(1929).—For atoms like O and halogens homopolar bonds would be impossible on account of the occurrence of antiparallel spin direction in their electrons. It is called that the abnormalities of the magnetic quantum no. of these atoms can lead to coupling energies between their orbit momenta of the order of the exchange energy and possibly to mol. formation. B. J. C. VAN DER HOEVEN

Properties of the He₂ rotation terms. W. E. CURTIS AND A. HARVEY. *Nature* 124, 12(1929).—In the analysis of the band spectrum of He₂ now nearly complete, a special difficulty arises in that very considerable changes occur in the bands as the principal electronic quantum no. n increases, e. g., a band which is completely provided with P, Q and R branches for $n = 3$, is reduced to a single R branch (but of P form) when $n = 6$. Certain regularities are pointed out by which the impossibility of analysis by finding combination relationships is surmounted. W. WEST

Effect of a nuclear spin on the optical spectra. I. HARGREAVES. *Proc. Roy. Soc. (London)* A124, 568-91(1929).—By using six dynamical variables for the spins of the nucleus and electron, the effect is calculated of a nuclear magnetic moment h on the optical spectrum of an atom with a central field, and the results compared with Jackson's recent observations for Cs. FRANK URBAN

Molecular rays of uniform velocity. B. LAMMERT. *Z. Physik* 56, 244-53(1929).—App. is described for the production of H atom rays of uniform velocity. Maxwell's law of velocity distribution is tested and proved. GEORGE GLOCKLER

Dissociation of molecules caused by rotation. O. OLDENBERG. *Z. Physik* 56, 563-75(1929); cf. Franck, *C. A.* 20, 518, and Condon, *C. A.* 21, 1092. G. G.

Rate of formation of bromine molecules from atoms. V. KONDRAT'EV AND A. LEIPUNSKII. *Z. Physik* 56, 353-61(1929).—From intensity measurements of the continuous spectrum emitted when the reaction $\text{Br} + \text{Br}^* \rightarrow \text{Br}_2 + h\nu$ occurs, it is found that such direct combination of two atoms to form a mol. is a very rare event. The order of magnitude of the probability is between 10^{-8} and 10^{-9} . Cf. *C. A.* 23, 361. GEORGE GLOCKLER

Detection of atom debris from aluminum with the Hoffmann electrometer. H. POSE. *Naturwissenschaften* 17, 623(1929). The H rays studied were produced by Po from a 30 μ Al foil in the direction of the primary radiation. The no. of H-particles is represented in a curve as a function of the range. A great no. is found of range up to 30 cm., less up to 47 cm., a few up to 60 cm. At 62 cm. the yield was 0.01 (per 10^8 α -particles). The results are in good agreement with those of Schmidt (*C. A.* 21, 2601). B. J. C. VAN DER HOEVEN

Examination of atom debris from aluminum with the tube electrometer. E. A. W. SCHMIDT. *Naturwissenschaften* 17, 544-5(1929).—With the electrometer of Ortner and Stettner (*C. A.* 23, 3623) previous expts. (*C. A.* 21, 2601) were repeated. With α -particles of 3.9 cm. range the H rays from Al were detected at 60 cm. air equiv. distance; the effect is still measurable at 55 cm. The results of the previous work were confirmed. The no. of H particles decreases rapidly with decrease in α -ray range. For 3 cm. range of α rays only $\frac{1}{10}$ of the H rays appears at 19 cm. distance as compared with 3.9 cm. range. For 2.15 cm. α -ray range only traces of addnl. H-rays appear beyond their natural range of 16 cm. B. J. C. VAN DER HOEVEN

Deflection of molecular rays by the lattice of a crystal face. OTTO STERN. *Naturwissenschaften* 17, 391(1929). From de Broglie's theory the wave length for a He mol. ray is 0.57×10^{-8} cm.; it should be deflected by a NaCl lattice. On continuing previous expts. (cf. Knauer and S., *C. A.* 23, 2889), it was found that the reflection is strongest when the cube face is either parallel or at 45° to the plane of incidence of the

beam. The maxima of the reflected beam were quite as to be expected from the theory.

B. J. C. VAN DER HOEVEN

The metastable forms of neon, argon and mercury. H. B. DORGELO. *Wis-en Natuurk. Tijdschr.* 3, 65-8(1927); *Physik. Ber.* 9, 2318.—The s_2 and s_3 forms of Ne are metastable. Their life periods were measured as in C. A. 21, 1588; they were about $1/250$ and $1/2000$ sec., resp. Theoretical considerations are given. ALBERT L. HENNE

Critical remarks on concentration determinations of atoms and ions by light absorption. W. DE GROOT. *Physica* 9, 263-70(1929); cf. C. A. 23, 3623.—It is shown that errors of up to 25% in concn. are easily made in detns. by optical means due to self absorption of the emitting light source with a measurable thickness. The temp. in the absorption tube (Doppler effect) is another source of error. For absorption measurements with continuous background deviations can be caused by the width of the radiation, for high concns. the absorption increases strongly on account of this (width of spectral line assumed to be detd. by Doppler effect). This effect itself is sufficient to explain the apparent increase in absorption of org. compds with foreign gas admixture (Tevens, C. A. 22, 2514) and consequent increase in line width beyond the Doppler width. Similar remarks can be made about the density detns. of interstellar Ca (Wilson, *Astrophys. J.* 68, 423(1928)). B. J. C. VAN DER HOEVEN

The mercury hydride formation and spectrum. NIKOLAJ DZIEDZICKI. *Compt. rend. soc. polonaise phys.* 3, 207-30(1928); *Physik. Ber.* 9, 1792-3.—In Polish with French summary. A Hg arc in a cooled quartz lamp fitted with an Fe anode has been photographed. At the anode of the cooled lamp, the series lines only are detected, whereas in the ordinary Hg lamp addnl. lines of unknown origin are seen. At the cathode, arc and spark lines are seen. If H is fed to the lamp, all the H and Hg lines, and H₂H bands appear. With increasing H pressure, the latter's relative intensity increases to a max. The equl. H, Hg, H₂H has been computed. The pressure in the lamp decreases when the tension increases, and it decreases still more when the current is switched off. The decomn. of the H₂H mols is retarded by H pressure. The formation velocity increases with both current intensity and voltage. The H₂H formation becomes detectable above 11 v. By modification of the arc length, it has been shown that at the cathodic dark space is probably the reaction location. A quartz vessel filled with H and Hg does not show any pressure decrease after a one-day irradiation with an ordinary quartz lamp. ALBERT L. HENNE

A recent crisis in the undulatory theory of light. L. DE BROGLIE. *Rev. Sci.* 67, 355-60(1929). A conference. B. reviews the facts and hypotheses concerning the corpuscular and undulatory theories of light. P. THOMASSET

The spectrum of sunlit aurora rays as compared with the spectrum of lower aurora in the earth's shadow. CARL STÖRMER. *Nature* 124, 263-4(1929).—The green auroral line 5577 is much fainter in the sunlit spectra than in the spectra of aurora in the shadow. GREGG M. EVANS

Isotope effect in spectra and precise atomic weights. W. F. GLAUQUE. *Nature* 124, 265(1929).—For the detn. of packing effects very exact at. wts. will be necessary for isotopes some of which occur in extremely small proportions. When sufficient data are available band spectra will suffice for such work, at least as far as the comparison of isotopes of the same element. GREGG M. EVANS

The nature of the penetrating rays (cosmic rays). PIERRE AUGER AND D. SKOBELEZKY. *Compt. rend.* 189, 55-7(1929). The authors have studied the high-velocity electrons observed by Bothe and Kolhörster (cf. C. A. 23, 1566). They show that they are probably secondary electrons released by energy quanta from high frequency electromagnetic waves rather than primary cosmic electrons. GREGG M. EVANS

The nature of cosmic radiation. A. K. DAS. *Naturwissenschaften* 17, 543-4(1929). From calcns. using various data for radii of quanta and electrons also relativistic assumptions it is concluded that H nuclei at a speed of 0.7 the velocity of light would behave exactly like cosmic radiation. B. J. C. VAN DER HOEVEN

The formation of ozone in the upper layers of the atmosphere. WILHELM ANDERSON. *Physik. Z.* 30, 485-7(1929). A theoretical discussion. Thermodynamical considerations are adduced to show that under the influence of electron radiation on the O in the atm. the max. O₃ formation would occur at 40 to 50 km. above the earth. R. H. FERGUSON

Simple relations between more intense and higher radiations of chemical elements in the bright atmosphere of the sun. H. DESLANDRES. *Compt. rend.* 188, 1909-73(1929). cf. C. A. 23, 2884.—Sixteen simple substances of which the ultimate lines are connected in the table to multiples of d_1 , elementary frequency 10025, are H, He and He⁺, Be⁺, O, Na, Mg⁺, Si, Ca⁺, Sc⁺, Ti⁺, Cr and Cr⁺, Cu, Zn, Sr⁺, Y⁺, Ba and

Ba⁺. Ten have at. wts. which are multiples of 4. Not counting H, 5 are odd. The causes which det. the intensity of the spectral lines and their frequency are probably connected with the frequency of 1062.5, with He and H nuclei, with the arrangement of the same elementary nuclei in the nucleus of the heavier atom, and with the acting forces now little known, at very short distances, between electrons, protons and He nuclei, and between atoms and mols.

L. D. ROBERTS

The transparency of various materials to ultra-violet radiation. PHILIP WRIGHT. *Brit. J. Radiology* 2, 434-8(1929).—A spectrographic study of the light from a quartz Hg-vapor lamp has been made after its passage through 38 different materials including crystals, celluloid, paraffins and a number of "ultra-violet glasses" on the market. Photographs of all the spectra are given, together with the min. wave length transmitted.

E. H. QUIMBY

Radium. GWENDOLYN HINDS. *Pharm. J.* 123, 233-4(1929).—A review of the history of the discovery of radium, its properties and therapeutic importance. S. W.

Some cases of radium physicochemical action. P. LAZAREV. *J. Applied Phys. Moskau* 5, 209-10(1928); *Physik. Ber.* 9, 2068 (in Russian with French summary).—Ra rays, filtered through mica, blacken borax glass. The color fades out after a few months of immersion in C₆H₆. Collodion films colored with cyanine are decolorized. The collodion becomes yellowish.

ALBERT L. HENNE

Discoloration due to radium rays as an aid in technical research. KARL PRZIBRAM. *Elektrotech. u. Maschinenbau* 47, 815-6(1929).—A brief review. C. G. F.

The chemical effects of radium radiations. S. C. LIND. *Am. J. Roentgenol. Radium Therapy* 21, 480-3(1929).—Decompn., synthesis, condensation and polymerization in gaseous, liquid and solid systems, produced by radium rays, are compared with the ionization produced by these rays. Equivalence is found in the no. of ions produced and the no. of mols. caused to react.

E. H. QUIMBY

Two simple methods of purifying radium emanation. WILLIAM G. MORAN. *Am. J. Roentgenol. Radium Therapy* 22, 147-50(1929).—A simple app. for the purification of Ra emanation is described, which is low in cost and easy of operation. The use of liquid air is avoided and the removal of water vapor is unnecessary. In one method of purification the O and H are ignited with a hot CuO₂ filament which also oxidizes the excess H. In the other an elec. spark is used. The concn. obtained compares favorably with that obtained with complicated and expensive installations.

E. H. QUIMBY

Thorium emanation. V. MATULA AND V. SANTHOLZER. *Chem. Obzor* 4, 14-5, 80(1929).—Criticism of Šebor's contribution on thorium emanation. C. A. 23, 4879.

JAROSLAV KUČERA

Wave-mechanical calculation of the radioactive decay constants. TH. SEXL. *Z. Physik* 56, 62-93(1929).—Mathematical. Cf. Möller, C. A. 23, 4402. G. G.

Determination of decomposition products of atomic disintegration. G. HOFFMANN AND H. POSE. *Z. Physik* 56, 405-15(1929).—The ionization caused by a single fast-moving H-particle is measured by a sensitive electrometer. The H particles knocked out of Al foil by α -particles of Po are detd. Cf. Ortner and Stetter, C. A. 23, 3623.

GEORGE GLOCKLER

Detailed study of the radioactive decay of, and the penetration of α -particles into a simplified one-dimensional nucleus. R. H. FOWLER AND A. H. WILSON. *Proc. Roy. Soc. (London)* A124, 493-501(1929).—The problem of α -particle disintegration (detn. of the complex characteristics of the wave equation with the proper boundary conditions) has been solved exactly. The converse problem of the penetration of an α -particle into the nucleus from without has been discussed.

FRANK URBAN

A novel simple process for manufacture of concentrated radium emanation preparations. P. M. WOLF AND N. RIEHL. *Naturwissenschaften* 17, 566-7(1929).—Some species of adsorbent carbon have a distribution coeff. relative to air of as much as 1700 for Rn. A simple app. is described for the transfer of this gas from a Ra salt to a small gold or glass capillary container filled with active C; the adsorption is 90%. For the Ra prepn. the strongly emanating Hahn substances were used which consist of Ra adsorbed on Fe hydroxide gel. The prepn. of Rn made in this manner had activities up to 0.5 to 2 millicuries per cm. length; they are most useful for tumor therapy.

B. J. C. VAN DER HOEVEN

Uranium and radium ore deposits of Katanga. O. EISENTRAUT. *Ber. Freiburger Geol. Ges.* 1927, 22; *Neues Jahrb. Mineral. Geol.* 1928, I, 53-4; *Chem. Zentr.* 1928, I, 2073.—A description of the mines in Katanga which produce radioactive minerals.

C. R. FELLERS

The temperature coefficient of γ -ray absorption. L. BASTINGS. *Phil. Mag.* [7], 7, 337-45(1929).—An app. is described which is suitable for the measurement of γ -ray absorption at various temps. B. measured the absorption of γ -rays by Pb, Fe, Sn (solid and liquid) and Al at various temps. A temp. coeff. was found in spite of the extreme exptl. care used and the variation in the conditions of the expt. A correlation was found between coeff. of linear expansion and the temp. coeff. of γ -ray absorption. No theory was advanced to explain the results, but it was suggested that at. absorption is probably a function of the distance between the atoms of the absorber and not of the at. target.

L. H. REYERSON

The nature of the electron. E. RUPP. *Z. Ver. deut. Ing.* 73, 1109-14(1929).—A review.

FRANK URBAN

Diffraction of electrons. P. TARTAKOVSKII. *Z. Physik* 56, 416-20(1929).—Electrons of 1500 v. velocity show Debye diagrams when diffracted by an Al foil. Cf. Rupp, *C. A.* 23, 3402.

GEORGE GLOCKLER

Diffraction of electrons by a copper crystal. H. E. FARNSWORTH. *Nature* 123, 941-2(1929).—Measurements have been made, for bombarding potentials of 1 to 150 v., of the total secondary emission from a single Cu crystal under the same conditions as the angular distribution of scattered electrons. The total secondary electron curve shows 2 maxima at 3 and 10.5 v. Several marked changes in slope occur in the region between 10.5 and 150 v. Intense electron beams issue from the crystal at potentials for which the above maxima occur and at such potentials as to account for many of the changes in slope between 10.5 and 150 v. Others may be accounted for by the diffraction beams which would be expected to leave the crystal in the direction of the normal but are outside of the solid angle of observation. The energy levels of the atom at most play only a comparatively small part in the production of sudden changes in slope in this region, since the electron diffraction beams apparently depend only on the positions of the atoms and not on their structure. Most of the beams in the low-voltage region occupy the approx. positions to be expected by a wave of $\frac{1}{2}$ the length given by the usual expression $\lambda = h/mv$, if a value greater than unity is taken for the refractive index. Seven sets of electron beams issue from the crystal in the 2 principal azimuths which are the x-ray analogs and require a refractive index greater than unity. Eight sets of beams are found in the (100) azimuth which may be accounted for by assuming a wave length for the electron only $\frac{1}{2}$ that given by the formula $\lambda = h/mv$. One other weak set is unaccounted for by either of the above relations. In the (111) azimuth 3 sets are accounted for by the $\lambda/2$ relation. There are 4 other sets in this azimuth, 3 of which may possibly be accounted for by a $\lambda/2$ relation while one weak set appears anomalous. The 3-v. beams do not appear accurately and are not reproducible. Many of the beams are strong and sharp. With one exception, the set of beams accounted for requires a refractive index greater than unity. The voltage differences between the electron beams and their x-ray analogs in general increase with the voltage from about 6 or 7 v. for the lowest to about 30 v. for the highest voltage in the range below 150 v. The exceptional set (very weak) requires refractive index of about unity with the association chosen. The electron beams satisfying the $\lambda/2$ relation would also be accounted for by whole λ wave lengths and twice the atomic spacing for a Cu crystal and might thus suggest a surface gas grating having twice the Cu spacing. The beams observed from the Cu crystal, however, appear not to be due to gas, for they are space-grating, not surface-grating beams. It appears necessary to conclude either that there are wave lengths associated with the electron in addn. to that given by the formula $\lambda = h/mv$, or that the electron waves are scattered from alternate rows of the Cu atoms with different intensities, both in the plane grating and the space grating. Because of the 4-fold symmetry in azimuth, the crystal appears to be single.

ALBERT L. HENNE

New developments in the electronic theory of metals. I. Theory of electronic gas. YA. FRENKEL. *Scientia* 46, 1-12(1929); cf. *C. A.* 23, 3153.—F. reviews metallic conduction according to Drude-Lorentz and Sommerfeld. II. The theories of the solid electronic network and of the electronic liquid—application of wave mechanics. *Ibid* 87-94.—A semi-popular account of the solid electronic network theory of metals and that of the electronic liquid. The latter is distinguished from the former in that there is absence of positions of stable equil. for the electrons. LOUIS WALDBAUER

Elastic dispersion of electrons in argon and the Ramsauer effect. J. HOLTSMARK. *Naturwissenschaften* 17, 365-6(1929); cf. *C. A.* 23, 4403.—The elastic dispersion of electrons was calcd. for A on the basis of the theory of Faxen and H. (*C. A.* 22, 1273, 2710; 23, 1586) from the Hartree data of the atomic field of A. The field is given in a curve; the effective area of A vs. the square root of the electron speed is plotted

and compared with exptl. data of Bruche, the general character of the curve being the same. B. J. C. VAN DER HOEVEN

The phenomena of projected electrons. T. J. I. BROMWICH. *Phil. Mag.* [7], 7, 470-6(1929).—B. gives a more definite statement of the deductions from his previous treatment (cf. *C. A.* 22, 2107) with regard to the Einstein theory of relativity. L. H. REVERSON

The second-order wave equations of the spinning electron. G. TEMPLE. *Proc. Roy. Soc. (London)* A125, 152-6(1929).—Second-order wave equations satisfied by a wave tensor of the first rank are outlined which reproduce the general features of Dirac's theory by employing the non-commutative properties of the operators P and D to introduce the spin corrections into the Schrodinger-Gordan equation. H. W. WALKER

Deviation from Ohm's law at high current density and Sommerfeld's electron theory. H. MARGENAU. *Z. Physik* 56, 259-61(1929).—The mean free path of electrons in Ag recalc'd. on the new statistics agrees with Sommerfeld's theory (*C. A.* 23, 1538). Cf. Compton, *C. A.* 21, 2595. GEORGE GLOCKLER

The absorption coefficient for slow electrons in mercury vapor. ROBERT B. BRODE. *Proc. Roy. Soc. (London)* A125, 131-42(1929); cf. *C. A.* 19, 2778; 20, 332. The absorption coeff. is measured in Hg for electrons with velocities corresponding to from 0.5 to 400 v. No indication is found for small values of the absorption coeff. i. e., long free paths, at low velocities. A change in slope of the velocity absorption coeff. curve is observed at about 5 v., a min. at about 20 v. and a max. at 35 v. H. W. WALKER

Transmission and reflection of slow electrons by metals. E. RUPP. *Naturwissenschaften* 17, 365(1929).—It is shown from several graphs (for Cu, Ag, Au) that for slow electrons (4 to 40 v.) and thin metal foils characteristic absorption max. occur at practically (within 1 v.) the same speed as the reflection max. The curves are typical for each metal and independent of the angle of incidence. B. J. C. VAN DER HOEVEN

Emission of electrons from cold metals. T. E. STEEN, B. S. GOSSLING AND R. H. FOWLER. *Proc. Roy. Soc. (London)* A124, 699-723(1929). The simple theory has been extended. Space charge effects were negligible. If a suitable thickness was assumed to the surface film, the revised theory fitted satisfactorily with a const. emitting area. The simple equations were revised as the result of this investigation. F. URBAN

Ionization by collision in monatomic gases. J. S. TOWNSEND AND S. P. MACCALLUM. *Proc. Roy. Soc. (London)* A124, 533-45(1929). Atkinson's principles make it impossible to account for simple phenomena in elec. discharges in monatomic gases. The sparking potential is more sensitive than the spectroscopic method for detecting impurities. It would be quite impossible to form a theory of cond. on the hypothesis that electrons, when they acquire energies above certain crit. amts., lose energy in these amts. in collisions with atoms without taking into consideration the fact that the probability of any such losses occurring is small. FRANK URBAN

Mobility of ions in gases. R. J. VAN DE GRAFF. *Nature* 124, 10-11(1929); cf. *C. A.* 22, 4054(1928).—A new type of grid is described for the measurement of ionic mobilities. It consists of a series of closely spaced parallel, coplanar bars. Alternate bars are connected to one electrode, and the others to a second. A slight p. d. between the 2 sets of bars stops the passage of electrons or ions by deflecting them to the bars. W. WEST

Ion sources yielding positive ions. E. BADAREU. *Bul. fac. stiinte Cernauti* 1, 4-13(1927), *Physik. Ber.* 9, 403. The 2 principal sources of pos. ions are $AlPO_4$ and mixts. of Fe_2O_3 with traces of alk. salts, the latter being the so called Kunsman source. Several properties of these ion sources have been exam'd. in app. specially devised. During the first hr. of heating at 700-800°, the emission from $AlPO_4$ behaves erratically, but becomes const. after 13 hrs. At 500-600°, the emission reaches a const. value after only 1 hr. A satn. current is not reached. If the exciting tension is increased for a short time, then readjusted to its former value, the ionic intensity decreases. The following kinds of ions are probably emitted: Al ions, H atoms, H mols. The prepn. of Kunsman ionic sources is described: non reduced preps. give a high ionic yield, 10^{-6} amps./sq. cm., which slowly decreases. After a short period, reduced preps. give a very steady ionic current; in general, they behave like $AlPO_4$, but yield a larger no. of ions. $AlPO_4$ gives about 10^{-11} to 10^{-12} amp./sq. cm. A. L. H.

The kinetic energy of the positive thermions emitted by aluminum phosphate. E. BADAREU. *Bul. fac. stiinte Cernauti* 1, 1-3(1927), *Physik. Ber.* 9, 403. The energy of pos. ions, as they issue from metallic surfaces or heated salts, has been studied with $AlPO_4$. A Pt foil covered with $AlPO_4$ was heated to 700-800°, and the mixt. of pos.

ions was allowed to discharge in a Cu cylinder evacuated to 10^{-6} cm. A tension of 0.3 to 0.4 v. is sufficient practically to stop all the ions. This result agrees with that of F. C. Brown (0.5), whereas Grosman obtained 1.3 v. for several salts heated at 450° .

ALBERT L. HENNE

Thermionic emission of copper tubes filled with salts. T. PECZALSKI AND J. CICHOCKI. *Compt. rend.* **188**, 699 701(1929).—A Cu tube about 50 cm. long and 2 mm. in diam. was surrounded by a tube that could be evacuated. When the tube was empty there was no thermionic current. When the tube was filled with NiCl_2 , there was thermionic emission. A graph showing intensity of current as a function of time with the tube at 80 v. is given. Thermionic emission as a function of the potential of the tube is plotted. CrCl_3 and CaCl_2 give results less pronounced than NiCl_2 . It is concluded that the effect of salts on metals is accelerated when the metal carries a positive potential.

L. D. ROBERTS

Relative probabilities of the ionization of K and L electrons of equal ionizing energy. GERALD L. PEARSON. *Proc. Nat. Acad. Sci.* **15**, 658 64(1929).—The spectra at 55, 40, and 25 kv. from a special Coolidge x-ray tube, having a PbSe target, were photographed by the rotating-crystal method. The intensities of the lines of the K series for Se and the L series for Pb were measured with a Harrison comparison-micro-photometer. From these data the product $N\phi$ was calculated, where N is the probability that a cathode ray will produce ionization of the appropriate type and ϕ is the probability that subsequent reorganization will result in radiation of some line of the sub-series. This product is found to be independent of any difference in azimuthal quantum no. only, but a difference in radial quantum no., i. e., between K and L_{III} , has a marked effect.

W. W. STIFLER

Gas absorption in electron discharges. MICHAŁ PAWŁOW. *Compt. rend. soc. polonaise phys.* **3**, 101 15(1927); *Physik. Ber.* **9**, 568(1928).—An elec. discharge has been made to pass in a N atm. between 2 Fe electrodes, in the presence or the absence of Hg vapor, or between Hg electrodes. The pressure range was 1.25 to 0.1 mm. Hg, the tension 1200 v. and the current intensity 0.1 to 50 ma. With voltages higher than 600 v., N was absorbed, and a deposit of Fe nitride covered the glass walls. This Fe nitride is formed only from atomized Fe scattered by the cathode; this scattering starts a little below 600 v. When 2 Hg electrodes are used, and the other conditions are left unchanged, Hg nitride is found on the walls. Hg nitride is not formed when the discharge passes through an atm. containing Hg vapors between 2 Fe electrodes. Conclusion: cathodic atomization is essential for the formation of nitrides.

A. L. H.

The phenomena of spark discharges. WM. CLARKSON. *Phil. Mag.* [7], **7**, 322 31 (1929).—A résumé is given of the elec. and optical properties of spark discharges and the factors determining the optical properties of discharges are discussed. Observed phenomena agree with the ideas derived from general principles of discharges as schematized in dynamic characteristics. The scheme outlined, though simple, thus constitutes an adequate basis for the appreciation of spark phenomena. The curves for the variation of intensity of the arc and spark lines of He, with initial condenser voltage, are corrected for such factors as double max. in arc intensities and the falling off of spark intensities. The results then agree with theoretical considerations.

L. H. REVERSON

Atmospheric ionization. CH. MAURAIN AND E. SALLÉS. *Compt. rend.* **188**, 723 5(1929).—The ionization of the air at Paris and in the country (Val-Joyeux) has been determined with the following results per cc.: Number of small +ions in the country 45, small -ions 81, large +ions 620, large -ions 610, in Paris small +ions 86, small -ions 70, large +ions 16,710, large -ions 16,700.

L. D. ROBERTS

Effect of plastic deformation on the inner photoelectric effect in sodium chloride crystals. M. N. PODASHNEVSKI. *Z. Physik* **56**, 362 9(1929). GEORGE GLOCKLER

The photoelectric effect and the x-ray continuous spectrum. E. SEVIN. *Compt. rend.* **188**, 911 2(1929).—The photoelec. law and the max. frequency of the x-ray continuous spectrum resulting from the law of Duane and Hunt are deduced from S.'s theory of light (*Compt. rend.* **188**, 200).

B. C. A.

The photoelectric effect of aluminum and its amalgams. I. A. SMITS AND H. GRIJNDING. *Physik. Z.* **30**, 322 5(1929).—The addition of a trace of Hg to very pure passive Al increases the photoelectric current 5-fold. This is attributed to a modification of the inner state of Al.

F. R. BICHOWSKY

The electromagnetic field of an electron. The electron as a gravitational phenomenon. D. MEKSYN. *Phil. Mag.* [7], **7**, 425 33(1929).—Math. M assumes that an electron represents the same entity as neutral mass, with the difference that, whereas matter or energy is located in a particle in a very small region, in an electron it is spread

over all space according to the law A/r^4 , or, that an electron is a field of gravitation, whose potential is M/r^2 . The field of an electron is assumed to have no stresses.

L. H. REYERSON

The paramagnetic rotation of the plane of polarization near absorption lines. R. MINKOWSKI. *Naturwissenschaften* 17, 567-8(1929).—For spectral lines of Cs (8944 and 8521) at vapor pressures of 1 mm. faint asymmetries in rotation were observed; there were more distinct ones at higher pressures (10 mm.). This asymmetry was most noticeable at some distance from the spectral line. The effect is as expected from paramagnetic rotation found by Ladenburg (*C. A.* 22, 912). For the 8521 line the factor b was found to be $3.6 \cdot 4.1 \times 10^{-14}$, calcd. 3.6.

B. J. C. VAN DER HOEVEN

Investigation of the Becquerel effect. II. K. LIFSCHITZ AND S. B. HOOGHOUDT. *Z. physik. Chem., Abt. A*, 141, 52-70(1929); cf. *C. A.* 21, 3560; 22, 2712.—The Becquerel effect with light sensitive electrodes and with electrolytes is not as sharply sepd. as Winther supposed (*C. A.* 22, 1280). The Becquerel effect in electrolytes is not due to a simple, photochem. equil. as, e. g., exists with Ce salts. It occurs also in non-aq. solns. and is shown to be dependent on medium, kind of ions present and wave length, but independent of material and size of electrodes. It is very strongly influenced by impurities.

M. MCMAHON

X-ray diffraction by "Midu-Ame," and other substances in sheared states. MORISŌ HIRATA. *Bull. Inst. Phys. Chem. Research (Japan)* 8, 471-84(1929); Abstracts 2, 52-6.—Midu-Ame is a very viscous substance consisting chiefly of maltose and dextrin, with a small quantity of albumin. The Midu-Ame used was made from rice. X ray diffraction photographs were taken with a Coolidge tube, by using first a Mo and later a Cu anticathode. Two diffraction rings were observed, the inner and stronger corresponding to a spacing of from about 5.0 Å U. to 3.6 Å U., the outer to 1.2 Å U. The appearance of the diffraction rings does not change with temp., although the viscosity varies widely. Conspicuous changes appear because of the addn. of small quantities of water. Methods are described for examg. the substance at strained states, but no changes in the diffraction rings have been observed. The expts. are being continued in the hope of finding evidence that the mols. exist in the form of aggregates of considerable length. Other substances examd. by the same method were gelatin, glycerol, olive oil, ricinolic acid, triolein and melted palmitic acid. In these cases, likewise, no changes in the diffraction rings were observed due to strained states. C. J. H.

The photoelectric properties of some metals in the soft x-ray region. LETITIA P. DAVIES. *Proc. Roy. Soc. (London)* A119, 543-52(1928).—The photoelec. sensitivities of Fe, Co, Ni and Cu toward soft x-rays from targets of the same metals were tested. Thermionic emission was used to obtain the primary electrons and voltages of 300, 400, 500 and 600 were used. The soft x-rays passed through an elec. field to remove all pos. ions and electrons, and then were received upon a plate of the material under test. This plate was surrounded by an electrically charged cylinder which removed the photoelectrons. The photoelec. current in the plate was measured with a quadrant electrometer. Each target was used with each photoelec. detector. The results are given as the ratio of the photoelec. to the thermionic current, i_p/i_t . Cu and Co are less (approx. 17%) efficient as photoelec. detectors than Ni and Fe. In general, also, the Fe target gives the largest value of i_p/i_t for each detector, followed by Ni, and Ni in turn by Cu and Co, which give about equal values. K. L. HERSHEY

Emission of soft x-rays by different elements, with reference to the effect of adsorbed gas. U. NAKAYA. *Proc. Roy. Soc. (London)* A124, 616-41(1929).—The relation between the intensity of soft x-rays and the photoelec. current as a function of adsorbed gas mols. on the photoelec. plate has been investigated. By ascertaining the conditions necessary for reliable values, the emission of soft x-rays has been compared for Si, Cr, Mn, Fe, Co, Ni, Cu, Pd, W, Pt and Au.

FRANK URBAN

X-ray levels of the rare earths, and the deviations from Moseley's laws. G. PICCARDI. *Atti accad. Lincei* [vi], 8, 414-8(1928).—The regularities in the x-ray levels of the elements of the rare earths have been made the basis of a comparison of the corresponding levels of other elements of the periodic system. By using the values of the x-ray levels of the rare earths as the basis of the calcn. of the consts. in Moseley's law, the deviations of the levels for other atoms from the values obtained from this law have been plotted against at no. The irregular curves so obtained present certain regularities on analysis. The deviations for elements before the rare earths decrease (from pos. to neg.) on passing from the K level through the levels L_1 , L_2 , L_3 , etc., to the O level. For elements after the rare earths, the corresponding deviations are all pos., but do not exhibit the same regularities. Within a given set of x-ray levels a certain regularity is shown: e. g., the deviations for the L series increase in the order L_3 , L_2 ,

L₁. But whereas the curves for different sets of x-ray levels for the earlier elements are sep'd., for the heavier elements considerable overlapping occurs among the curves for the different series. The deviations for all levels are of the same order of magnitude, reaching max. values of about 4 with the lighter elements, when the levels are expressed as $\sqrt{\nu}/R$, where ν is the frequency and R the Rydberg const. B. C. A.

The emission of secondary electrons and the excitation of soft x-rays. O. W. RICHARDSON. *Proc. Roy. Soc. (London)* A119, 531-42(1928).—R. reviews the studies on secondary electron emission and soft x-ray production by slow electrons. According to the proposed mechanism, the primary electron beam produces about the same no. of soft x-ray quanta as of secondary electrons per cm. of track. However, the soft x-rays thus produced are very highly absorbed, the coeff. being approx. 10^6 times greater than that measured by transmission expt. The efficiency of x-ray production is about 10^{-6} , that of photoelec. action and secondary electron emission each about unity. The especially high absorption of soft x-rays near their point of production seem to be demanded for a complete explanation.

R. L. HERSHEY

A method of determining the axial ratio of a crystal from x-ray diffraction data: the axial ratio and lattice constants of zinc oxide. M. LUTHER FULLER. *Science* 70, 196-8(1929).—Several values approximating the axial ratio value found from the charts of Hull and Davey are selected and, for each of these, values of log "a" are calcd. from observed interplanar spacings and plotted on probability paper according to the method of Davey. That curve based on the most probably correct axial ratio is closest to being a straight line and from the 50% point of the true axial ratio curve the value of log "a" is read directly. Values for pure ZnO are $a = 3.235$ A. U., $c = 5.209$ A. U. and $c/a = 1.610 \pm 0.001$, for U. S. P. ZnO 1.608 ± 0.002 and for ZnS (wurtzite) 1.636 ± 0.001 . Three sets of probability curves are shown.

H. W. WALKER

The translation lattice of hydrated celluloses. K. WEISSENBERG. *Naturwissenschaften* 17, 624(1929).—Expts. previously reported (*C. A.* 23, 2652) were continued. A peculiar interference point then found in the x-ray diagram appeared to be caused by scattered radiation and is immaterial. The basis of the elementary body was found to be centered.

B. J. C. VAN DER HORVEN

Sodium chloride crystals with copper addition. M. FORRÓ. *Z. Physik* 56, 235-43 (1929).—Absorption bands at 255 m μ are studied. The stability of these crystals is better than judged by MacMahon (*C. A.* 23, 766).

GEORGE GLOCKLER

Doubling of x-rays and optical terms through electronic rotation, and the intensity of the cesium lines. G. GENTILE AND E. MAJORANA. *Atti accad. Lincei* [6], 8, 229-33(1928).—Theoretical. It is shown that the potential of Fermi not only allows of the satisfactory *a priori* detn. of the energy levels of the heavy atoms, but also gives derived values of great accuracy, considering the statistical nature of this theory of the atom, for the doubling of the x-ray and optical terms.

B. C. A.

Beryllium. OTAKAR WEDE. *Chem. Listy* 23, 382(1929).—Be is lighter than Al and is used in producing radiations of short wave lengths. It is about 17 times as transparent to x-rays as Al and may be used in the construction of x-ray tubes. F. M.

M series of rhenium. E. LINDBERG. *Z. Physik* 56, 402-4(1929).—A few new x-ray lines of the M series of Re are detd.

GEORGE GLOCKLER

An x-ray method for detection of lattice disturbances in metals. J. HENGSTENBERG AND H. MARK. *Naturwissenschaften* 17, 443(1929).—By measurement of the decrease in intensity of Debye-Scherrer lines with increasing deviation angles deformation in the metals can be detected (cf. *C. A.* 23, 2292). The intensity ratio of two lines of different deviation angle will be different for a deformed lattice as compared with a normal one. From ionometric measurement on annealed and rolled Ta, Mo and W it is shown that J_{100}/J_{100} reflection ratio is, resp., 5.05 and 7.0, 8.35 and 9.4, 4.55 and 6.25 (7.5 for strongly hammered W). The ratio increases as was expected with increasing deformation. The deviations of the atoms from the normal lattice positions are about $1/100$ of the cell dimensions.

B. J. C. VAN DER HORVEN

X-ray examination of some salts of the fatty acids. STEPHEN H. PIPER. *J. Chem. Soc.* 1929, 234-9.—X-ray photographs of K salts of fatty acids were made by reflecting the K_{α} rays of Cu or Fe from thin layers of the salts pressed on a glass strip. Deliquescent salts were mounted in desiccators provided with special animal-membrane windows. Measurements were made both on a series of normal salts and on a series of acid salts (i. e. equimolal compds. of free acid and neutral salt). Only one form of salt appears to exist. The spacings of the odd and even neutral salts form one straight line when plotted against the no. of C atoms; the acid salts form another straight line of greater slope. The effective length of the CH_2 group is 1.03 A. U.

for neutral and 1.275 A. U. for acid salts. The latter value is too great for a linkage having the tetrahedral angle, $109^{\circ} 28'$ between the lines joining the centers of successive atoms, at least $111^{\circ} 46'$ being required. Some Na and Tl normal salt-spacings --- recorded.

R. L. HERSHEY

Measurement of the effective wave length of screens used in pyrometry. MENDOUSSE. *Compt. rend.* 189, 30-2(1929).

W. F. MEGGERS

A new spectrum of gaseous alkali halides. K. SOMMERMEYER. *Z. Physik* 56, 548-62(1929).--The absorption spectra found are due to transitions from the normal state to the lowest electronically excited state of the mol. From the data are detd. the dissocn. energy of the mols. into normal atoms and many normal vibrational levels. The heat of dissocn. of the mols. into ions is calcd. The alkali halides are "ion-molecules." Cf. Beutler and Josephy, *C. A.* 23, 2886

GEORGE GLOCKLER

The spectrum of the corona. E. M. LINDSAY. *Nature* 124, 94(1929).--The possibility that the corona lines might be due to the occurrence of "forbidden" transitions between terms in the Fe II, Ca II, Ti II, Ti III and Al II has been examd. Wave lengths corresponding to 500 forbidden transitions have been computed but in no case have any coincidences been found between these and the coronal wave lengths. W. F. M.

Intensity measurements on multiplets of mercury and neon excited by electron impact. W. ENDE. *Z. Physik* 56, 503-15(1929)

GEORGE GLOCKLER

Excitation of argon spectrum by electron impact. B. SCHULZE. *Z. Physik* 56, 378-93(1929).

GEORGE GLOCKLER

Excitation function of helium lines. W. HANLE. *Z. Physik* 56, 94-113(1929).--The optical excitation functions of various He lines are detd. between the resonance potential and 450 v. All lines have a max. in their excitation functions. Cf. Hughes and Lowe, *C. A.* 17, 2235.

GEORGE GLOCKLER

The critical potentials and low-voltage arcs in hydrogen. STEFAN VENCOV. *Compt. rend.* 189, 27-30(1929).--Although numerous exptl. researches have been made with the object of explaining the spectra and crit. potentials of H₂, a coherent interpretation of all the published results is difficult to give because too often the simultaneous use of spectrographic analysis and elec. measurements has been neglected. By taking special precautions with the method of electron collisions the following crit. potentials are observed in pure H₂: resonance of the mol. at 11.5 ± 0.5 v. at ionization at 13.6 ± 0.2 v., dissocn. of the mol. with notable increase of ionization at 16.5 ± 0.5 v., dissocn. followed by double ionization at 29.7 ± 0.6 v. From this it appears that the work of dissocn. of the H₂ mol. corresponds to about 3 v., which value agrees very well with electrochem. detns. The spectrographic results will be given later. (See following abstract.)

W. F. MEGGERS

Excitation of hydrogen spectra by electron collision. STEFAN VENCOV. *Compt. rend.* 189, 279-80(1929).

W. F. MEGGERS

The Hg II spectrum in the infra-red. EBBE RASMUSSEN. *Naturwissenschaften* 17, 389-90(1929).--The first spark spectrum of Hg was examd. between 6000 and 10,600 A. U. with a plane grating spectrograph; the results check with those of Paschen (*C. A.* 23, 2655). A strongly condensed discharge in a Pyrex bulb was used; the lines were measured against Fe and Ba standards. Details are discussed. The $^1D_2 - 2P_2$ lines was found; of 70 lines λ , term, ν found and ν calcd. are given

B. J. C. VAN DER HORVEN

Recording apparatus for infra-red spectroscopy. O. REINKOBER. *Z. tech. Physik* 10, 263-8(1929).--An automatic app. is described which records infra-red spectra by a system of relays, clock works, etc.

B. J. C. VAN DER HORVEN

The near infra-red spectra of helium and mercury. T. TAKAMINE AND T. SUGA. *Sci. Papers Inst. Phys.-Chem. Research* 11, 131-7(1929).--The phosphoro photographic method is compared with sensitized photographic plates for investigating infra red spectra. A ZnS screen was employed in the former, and for the photographic expts. Eastman "Infra-red Sensitive" plates were used. The latter were hypersensitized with NH₃ immediately before using, and during the exposure they were maintained at about 100° . With a He Geissler tube excited by strong current and a small glass spectrograph the He line at 1.084μ was recorded with 5-min. exposure. Approx. wave lengths of some He bands and of some Hg lines between 0.7μ and 1.0μ are detd. The sensitized photograph possesses better resolution; the phosphorescent screen is more sensitive and extends somewhat farther in the infra red, but it must be mentioned that ZnS has a narrow region near 1.1μ where the action of the infra red is a min.

W. F. MEGGERS

Infra-red radiation in mercury vapor. W. KROEBEL. *Z. Physik* 56, 114-30

(1929).—The infra-red radiation ($\lambda = 218\mu$ and $\lambda = 343\mu$ from a Hg arc is due to an excited metastable Hg mol. Cf. J. Franck and W. Grotrian, *C. A.* 16, 3037.

GEORGE GLOCKLER

Study in the infra-red region $\lambda 20-40\mu$. L. KELLNER. *Z. Physik* 56, 215-34 (1929).—Paraffin is fairly transparent in the region of $\lambda 20-40\mu$ and serves well as filter and window. The absorption coeff. of NaCl is detd. Calcite has a max. for reflection at 32.8μ .

GEORGE GLOCKLER

Further investigations on incoherent scattering in gases. F. RASETTI. *Nature* 124, 93(1929).—New app. contg. gases at 10 atm. pressure, and ultra-violet excitation are used to obtain the Raman spectra of gases. A purely electronic transition in the scattering process is observed for the first time in the NO mol. W. F. MEGGERS

Anomalous dispersion of sodium vapor. A. FILIPPOV AND V. PROKOVIEV. *Z. Physik* 56, 458-76(1929).—The transition probabilities (A_n) of the principal series of Na are detd. and found to agree with Schroedinger's wave-mechanical calcs. for the first 4 doublets. From the 11th doublet the law is $A_n = c/n^3$, where $c = \text{const.}$ and $n = \text{total quantum no.}$

GEORGE GLOCKLER

Metallic spectra in explosive gaseous mixtures. S. KALANDYK, L. KOZLOWSKI AND T. TUCHOLSKI. *Compt. rend. soc. polonaise phys.* 3, 241-55(1928); *Physik. Ber.* 9, 1790. (In Polish with German summary.)— SrCl_2 , KCl, CaCl_2 , FeSO_4 and CuCl_2 were added to mixts. of H_2O , CO_2 and illuminating gas- O . The explosion was photographed, and the spectra were compared with the flame spectra of the above substances. The bands of SrCl_2 located between 3650 and 4130 Å. U. disappear practically completely. At a sufficient concn., the Sr line 4908 Å. U. reverses and widens asymmetrically. With CaCl_2 , the spark lines show more brightly than in the ordinary flame spectrum; the bands between 3960 and 3652 Å. U. fade completely out. With FeSO_4 , lines appear at 3498, 3521 and 4261 Å. U. With CuCl_2 , the band spectrum is completely modified.

ALBERT L. HENNE

The band spectrum of helium. WALTER WEIZEL AND ERICH PESTEL. *Naturwissenschaften* 17, 390(1929). Further classification of singlet and triplet bands in the He spectrum is given.

B. J. C. VAN DER HOEVEN

Helium band spectrum. W. WEIZEL AND E. PESTEL. *Z. Physik* 56, 197-214 (1929).—Band spectrum analysis. Cf. *C. A.* 21, 3553.

GEORGE GLOCKLER

A study of the helium band spectrum. III. S. IMANISHI. *Sci. Papers Inst. Phys. Chem. Research (Japan)* 11, 159-49(1929), cf. *C. A.* 23, 4140. (In English.)—New wave-length measurements are presented for the ultra-violet He bands which are higher members of the series $2^1\sigma\Sigma - m^1\pi\Pi$. Of these bands those at 3080 Å. U. and 3045 Å. U., for which $m = 8$ and 9, resp., are new, and have been analyzed. The electronic frequencies of the bands are accurately represented by the Rydberg formula $\nu_e = 33494.8 - [R(m - 0.07256)^2]$ in which $R = 109,740 \text{ cm}^{-1}$. C. C. KIESS

Spectrum of doubly ionized arsenic. A. S. RAO AND A. L. NARAYAN. *Nature* 124, 229(1929). About 45 lines of the As III spectrum are classified as combinations of quartet terms, the terms identified being $5s\ ^4P$, $5p\ (^4P, ^4S, ^4D)$ and $5d\ (^4D, ^4F)$.

W. F. MEGGERS

Second spark spectrum of selenium (Se^{++}). D. K. BHATTACHARYYA. *Nature* 124, 229(1929).—By the application of the extended irregular doublet law combined with the method of horizontal comparison, the most important multiplets, $3^2P - 3^2S$, $3^2P - 3^1P$, $3^2P - 3^1D$, in the Se III spectrum are identified.

W. F. MEGGERS

Bands in hydrogen related to the Fulcher system. IAN SANDEMAN. *Proc. Roy. Soc. Edinburgh* 49, 245-55(1929); cf. *C. A.* 23, 3162. A comprehensive analysis of the Fulcher bands of H_2 was recently published by Richardson and Das (*C. A.* 23, 2096) and simultaneously by Sandeman (*C. A.* 23, 3162). These two investigations differ in no essential detail as far as the structure of the α -bands of the Fulcher system is concerned, they are ascribed to the mol. transition $3^2P - 2^4S$. The work of Richardson and Das also included an investigation of the β bands ($4^1P - 2^3S$) and of a new set of bands discovered by them in the infra-red. The last mentioned system, which consists of P and R branches only and has the same final terms as the Fulcher bands has been identified by Richardson and Das with the molecular transition $3^3S - 2^3S$. The purpose of the present paper is to show that these bands are in reality the higher members of a more extensive system, the band identified as the null band $0 \rightarrow 0$ should have been identified as the band $2 \rightarrow 0$, while two additional vibrational levels have to be added on the infra-red side. Various tests are applied to prove the correctness of the new arrangement, and a table giving the consts. of the 2^3S and 3^3S states is appended.

W. F. MEGGERS

The complexity of the terms of the resonance spectrum of tellurium vapors.

WITOLD KESSEL. *Compt. rend.* **189**, 94-6(1929).—The vapors of Te, Se and S emit, under the action of a monochromatic radiation, resonance lines forming a series the different terms of which may be represented by a simple formula. Perfection of a method of producing very intense resonance radiation, and the use of a spectrograph with high dispersion, have shown in the case of Te that the different terms have rather complicated structures.

W. F. MEGGERS

Spectroscopic observations of the low-voltage nitrogen arc. HIDENORI HAMADA. *Science Repts. Tohoku Imp. Univ.* **18**, 155-64(1929).—The distribution of spectra in all parts of the low-voltage N arc was investigated under various conditions of excitation, an ordinary hot-cathode tube with two electrodes being used. It was convenient to distinguish 3 forms of glow depending on the distance between the electrodes: (1) when the distance is short, the glow appears with a nearly uniform luminosity between the electrodes; (2) when this distance is moderate the pos. column and the neg. glow corresponding to that in the usual type of Geissler's tube are visible separately; (3) at greater distances the pos. column breaks into two or more striations, and the lowest potential forming 2 striations is 54 v.

W. F. MEGGERS

Intensities in the calcium spark spectrum. A. ZWAAN. *Arch. neerland. sci.* **III**, 12A, 1-76(1929).—Theoretical calcs. of the relative intensities of 5 lines in the spectrum of ionized Ca.

W. F. MEGGERS

The transition probability between two states with positive or negative energy in a central field due to nuclear charge Ze. YOSHIKATSU SUGIURA. *Sci. Papers Inst. Phys.-Chem. Research* **11**, 1-80(1929).

W. F. MEGGERS

The arc spectrum of germanium. K. R. RAO. *Proc. Roy. Soc. (London)* **A124**, 465-77(1929); cf. *C. A.* **22**, 3584.—Observations of the arc spectrum of Ge extending to 1630 Å. U have added about 50 new lines. Most of the 140 lines listed (4686 to 1640 Å. U) have been classified as combinations of singlet terms, triplet terms or inter-system. Detection of higher members of some of the series in the ultra-violet made possible a calcn. of the abs. values of the terms. The largest term, $4p^3P_0 = 65,558.0$ corresponds to an ionization potential of approx. 8.09 v. for Ge atoms. A comparison of the term values for the C I, Si I, Ge I and Sn I spectra is added.

W. F. M.

The third positive carbon and associated bands. R. K. ASUNDI. *Proc. Roy. Soc. (London)* **A124**, 277-96(1929).—The numerous band spectra associated with C have long been divided into two main divisions, the pos. and the neg. bands. The first group contains the first pos. or Swan bands, the second pos. or Ångström bands, the third pos. and the fourth pos. bands, all of which except the Swan bands are now attributed to the neutral CO mol. The first neg. or Deslandres' bands are due to CO⁺. In recent years several new band systems have been added to the pos. list and two, the comet-tail or low pressure bands, and the Baldet-Johnson combination bands to the neg. bands. The present paper deals mainly with the third pos. C bands, extending from 2825 to 3493 Å. U., with the 3 A bands and the so-called Wolter spurious bands, all of which were photographed in the first order of a 21-foot grating. A complete vibrational analysis of these three systems is given; it shows that all have the same final electronic state. The fine structure analysis of the 0-0 and 0-1 bands of the third pos. system shows that the final level of these bands is a quintet P level, the transition being $^5S \rightarrow ^5P$. The moment of inertia for this final state is 13.91×10^{-40} g. cm.²

W. F. MEGGERS

Spectrum of trebly ionized bromine. SURESH C. DEB. *Nature* **123**, 981(1929).—The chief lines of the group N₂ (O₁ ← O₂) have been located in the Br IV spectrum. Singlet and triplet terms, and inter-system combinations have been established.

W. F. MEGGERS

Structure of the band spectra of the hydrogen and helium molecules. G. H. DIEKE. *Nature* **123**, 979(1929).—Remarkable analogy between the bands of H₂ and those of He₂ has been revealed by the discovery of 7 branches of He₂ bands predicted from theoretical considerations but not previously found. Details will be given in another paper.

W. F. MEGGERS

Absorption spectra of negative halogen ions in solution. J. FRANCK and G. SCHEIBE. *Z. physik. Chem., Abt. A., Haber Bd.*, **139**, 22-31(1929).—The continuous absorption spectra of halogen ions in aq. soln. observed by G. Scheibe and his associates are ascribed to a photochem. dissociation process of the neg. ions into atoms and free electrons; that is, they are interpreted as electron affinity spectra. It is shown that the wavelength range and the form of the absorption curves is in accord with this explanation.

W. F. MEGGERS

Flutings in the absorption spectrum of a mixture of mercury and cadmium vapors. J. G. WINANS. *Phil. Mag.* [7], **7**, 565-6(1929).—New flutings are observed in a mixt.

of Hg and Cd vapor, on the long wave length edge of the Cd band which had broadened with pressure from the 2288 Å. U. line; a table of the wave lengths of these flutings is given. They are due in all probability to Hg Cd mols. L. H. REYERSON

The energies of dissociation of cadmium and zinc molecules from an interpretation of their band spectra. J. G. WINANS. *Phil. Mag.* [7], 7, 555-65(1929); cf. *C. A.* 23, 2876.—New observations on the absorption spectrum in Cd vapor show the development of the at. line 2288 Å. U. into a band from 2207 to 2800 Å. U. with increasing pressure. A set of diffuse flutings over the range 2650-2780 Å. U. develops on this band above 130 mm. pressure. The absorption bands at 2212 Å. U. and 2214 Å. U. were also observed, appearing at a pressure of 7 mm. The electrodeless discharge in Cd vapor shows a continuous spectrum with maxima at 2288, 2980, 3000 and 4400 Å. U. The band at 2114 Å. U. appears but the 2212 Å. U. band is absent. The Cd band at 2207 to 2800 Å. U. is attributed to absorption of light by 2 colliding atoms, the end product being a stable excited mol. The energy of dissocn. of Cd mols. is 0.200 v. as calcd. from the main absorption band. A similar explanation applied to the absorption spectrum of Zn gives an energy of dissocn. of 0.246 v. for Zn mols. The energies of dissocn. of Zn, Cd and Hg mols. are proportional to the at. heats of fusion. The 2114 band of Cd and the 2002 band in Zn may be represented by an absorption to a stable mol. state, whose vibration levels converge to $2^{1/2}S$ or $3^{1/2}D$. The flutings in the main absorption band are attributed to absorption of light by colliding atoms to form an excited mol. and the subsequent omission of this light when the excited mol. returns to the normal state. L. H. REYERSON

Continuous spectrum of the hydrogen atom. D. CHALONGE AND NY TSI ZÉ. *Compt. rend.* 189, 243-5(1929).—It has been shown (*C. A.* 23, 3162) that an uncondensed discharge through a tube contg. pure, dry H at several mm. pressure produces a continuous spectrum in which the distribution of energy remains const. within very wide limits of excitation. Expts. are made to det. if different types of discharge will modify the energy distribution. When one passes from an uncondensed to a moderately condensed discharge the appearance of the tube changes but little, the intensity of the Balmer lines increases but the continuous spectrum remains the same. When the capacity exceeds a certain value the discharge changes suddenly, the secondary spectrum and the continuous spectrum weaken and the Balmer lines predominate. Further increases in capacity produce remarkable changes in the energy distribution in the continuous spectrum. W. F. MEGGERS

Higher spark spectra of neon and argon in the extreme ultra-violet. J. C. BOYCE AND K. T. COMPTON. *Proc. Nat. Acad. Sci.* 15, 656-8(1929).—An electrodeless ring discharge has been employed to excite the spectra of doubly and trebly ionized A and Ne, which lie in the extreme ultra-violet. A list of lines, arising from the excitation of an s electron into one of the unoccupied p levels, and their classification, is given for each of the spectra Ne III, Ne IV, A III and A IV. From estimates of the sepns. of the ground terms of these spectra ionization potentials of 63.2 v. and 40.7 v., resp., have been derived for Ne^{++} and A^{++} . C. C. KIESS

The magnetic separation in the spectrum of ionized krypton. C. J. BAKKER AND P. ZEEMAN. *Proc. Acad. Sci. Amsterdam* 32, 565-77(1929). (In English).—Zeeman effects have been accurately measured for lines of Kr II which arise from combinations of terms coming from the $5s$ and $5p$ electrons. From the observed magnetic patterns g values are detd. which obey the g -sum rule although anomalous; i. e., they deviate from those given by Lindé's formula. A comparison of the g values of analogous terms in the spectra of Ne II, A II and Kr II shows an increasing deviation from Landé's g values with increasing at. no. C. C. KIESS

The ultra-violet spectrum of magnesium hydride. II. The many-lined γ -system. R. W. B. PEARSE. *Proc. Roy. Soc. (London)* A125, 157-79(1929); cf. *C. A.* 23, 2104.—The γ -system of MgH bands differs from the α and β systems already described (*C. A.* 23, 2104). They extend from about 5000 Å. U. to below 2100 Å. U. and show no prominent heads, although heads composed of relatively weak lines and degraded toward the red can be detected near 3100 Å. U., 2940 Å. U., 2720 Å. U., 2640 Å. U. and 2567 Å. U. Some of the bands have been measured and arranged into P and R branches with one line at the origin missing, thus indicating that the bands result from the electronic transition $^1S \rightarrow ^1S$. The band origins are represented by the formula $\nu_0 = 35904.5 + 1138.4(n' + 1/2) - 9.5(n' + 1/2)^2 - 1702.2(n'' + 1/2) + 34.2(n'' + 1/2)^2$, which shows that neither of the electron states involved is the same as those involved in the α and β bands. From a discussion of the initial and final electronic states of the α , β , and γ systems it is concluded that the γ bands are emitted by the ionized mol. MgH^+ . C. C. KIESS

Hyper-fine structure in spectral lines—especially those of singly ionized praseodymium. R. C. GIBBS, H. E. WHITE AND J. E. RUEDY. *Proc. Nat. Acad. Sci.* **15**, 642-6(1929).—Nearly 200 lines of Pr^+ between 5000 Å. U. and 3900 Å. U. are complex. The component sepns. of 33 of these have been carefully measured on spectrograms obtained in the 4th order of a 15,000-lines-per-in. grating giving a dispersion of 1.5 Å. U. per cm. The components of some lines show decreasing intervals and intensities toward shorter wave lengths, while others are similarly degraded toward the red. The results of the measurements are presented in a table. C. C. KIESS

Band spectra. RICHARD RUEDY. *J. phys. radium* **10**, 129-60(1929).—A review and summary of the present theoretical interpretation of band spectra. A bibliography is appended to the paper. C. C. KIESS

The spark spectrum of thallium, Tl III. J. C. McLENNAN, A. B. McLAY AND M. F. CRAWFORD. *Proc. Roy. Soc. (London)* **A125**, 50-3(1929).—The term structure of Tl III given by Carroll (C. A. **20**, 1560) has been corrected by a new assignment of first members of the F and G series, and extended by the detection of higher members of the S, P and D series. The new terms and the lines accounted for by them are given in the tables. From the value of the ground term $6s^2S_{1/2} = 240,600 \text{ cm.}^{-1}$ an ionization potential of 29.7 v. is derived for Tl. C. C. KIESS

The arc spectrum of chlorine. KANAKENDU MAJUMDAR. *Proc. Roy. Soc. (London)* **A125**, 60-7(1929).—The details of the analysis of Cl I previously announced (C. A. **23**, 1813) are now given. New wave lengths have been measured in the red and infra-red portions of the spectrum and have been classified as combinations between 4S and 4D terms with a common 4P term. Known lines in the violet have been identified as combinations between the next higher 4S and 4D terms with the same 4P term. The ionization potential derived for the neutral Cl atom is 13.1 v. C. C. KIESS

Regularities in the arc spectrum of arsenic. K. R. RAO. *Proc. Roy. Soc. (London)* **A125**, 238-46(1929); cf. C. A. **23**, 2361.—The arc spectrum of As has been reobserved between 8800 Å. U. and 1370 Å. U., new wave lengths being detd. for the lines between 3119 Å. U. and 1563 Å. U. Many of these lines have been classified as resulting from combinations between the low terms 4S , 3D , and 3P coming from the electron configuration $4s^24p^3$ of the normal state of the atom, and the higher terms coming from the excited $5s$ and $4p'$ states. The strong ultra violet triplet at 1972.6 Å. U., 1937.7 Å. U. and 1890.5 Å. U. constitutes the *raies ultimes* of As I, corresponding to the combination $4p^4S - 5s^4P$. C. C. KIESS

The anisotropy of the polarization field in liquids. K. S. KRISHNAN AND S. R. RAO. *Indian J. Physics* **4**, 39-55(1929). cf. C. A. **22**, 722.—The expression of Lorentz for the polarization field acting on any mol. in a refracting medium, is applicable to liquid media consisting of optically anisotropic mols. only if certain conditions are satisfied. The validity of these conditions is discussed. In mols. which are highly asymmetric in shape, the spherical symmetry of distribution is not realized. The result is that the polarization field is anisotropic, and its magnitude is evaluated from x ray data for some typical liquids and also indirectly from measurements on light scattering. The two sets of values agree. The anisotropy tends to approach a max. value at high d., and a min. value of 0 at very low d., in conformity with theory. H. W. LEAHY

The influence of mercury vapors on the continuous spectrum of hydrogen. HENRYK JÉZEWSKI. *Compt. rend. soc. polonaise phys.* **3**, 161-73(1927); *Physik. Ber.* **9**, 1107.—The spectrum of an elec. discharge through a mixt. of H and Hg vapor has been photographed with a quartz spectrograph. The pressure ranged between 1 and 40 mm., and the temp. reached 800°, at the max. If the Hg vapor tension increases (increasing temp.), the intensity of the H continuous spectrum decreases. To obtain a very intense spectrum, it is necessary to cool the discharge tube with a cooling mixt. Various excitation methods (high tension, condensed discharge, Tesla transformer) have no effect on the intensity distribution, but require an effective cooling. The long-wave limit is at about 5000 Å. U. The short-wave limit could not be detd. on account of the absorption of the quartz. The photometer curves of the continuous spectrum did not even show a trace of slope change in the vicinity of any Hg line. The expts. speak against the theory of Schuler and Wolf, which claims that the continuous spectrum is emitted during the reunion of dissociated H atoms. ALBERT L. HENSE

Vibrational quantum analysis of the red cyanogen bands. R. K. ASUNDI AND J. W. RYDE. *Nature* **124**, 57(1929).—Six new bands of greater λ than those previously known have been found in cyanogen with neocyanine plates, showing that the band at ν 14430 is not the 0 0 band. Assuming 10937 to be the 0 0 band, the vibrational equation is: $\nu_{\text{band}} = 10937 + (1782 \nu' - 13.5 \nu'^2) - (2055 \nu'' - 13.3 \nu''^2)$. W. WEST

Molecular absorption of iodine in the far ultra-violet. H. SPONER AND W. W. WATSON. *Z. Physik* 56, 184 96(1929).—Three regions of absorption are found: the region λ 1950–1780 Å. U. shows closely associated bands; at λ 1780 Å. U., a few bands at low pressure and at λ 1600–1500 Å. U. shows a further absorption region. Cf. M. Kimura and M. Miyaniishi, *C. A.* 23, 2097.

GEORGE GLOCKLER

Experimental test of the quantum-theoretical dispersion equation. II. RUDOLF LADENBURG. *Naturwissenschaften* 17, 296 9(1929); cf. *C. A.* 21, 1403–4.—A review of recent work of L. on neg. and pos. dispersion (L. and Wolfsohn *Nachr. Ges. Wiss. Göttingen* 1929; Kopfermann and L., *C. A.* 23, 1350). B. J. C. VAN DER HOEVEN

Effect of resistance on spark spectra. A. OCCHIALINI. *Atti accad. Lincei* [6], 8, 579 84(1928).—A continuation of O.'s work to perfect a method of quant spectroscopic analysis (*C. A.* 23, 4619). By using app. described previously, the effect of variable resistance, in the discharge circuit, on the spark spectrum of Pb is demonstrated. B. C. A.

Hyperfine structure in triplet spectra and the determination of nuclear moments. H. SCHÜLER AND H. BRÜCK. *Z. Physik* 56, 291 6(1929); cf. *C. A.* 23, 4406.—The assumption that an atom has a definite nuclear moment (const. for all states of the atom) necessitates new term schemes which are discussed for doublet and triplet spectra. Isotopes of the same atom have different nuclear moments. For instance Cd isotopes have nuclear moments $i = 1/2$ and $i = 0$. GEORGE GLOCKLER

Fine structure of the doublet of the main series of cesium. D. A. JACKSON. *Naturwissenschaften* 17, 364(1929).—Self reversal was excluded in the expts. previously reported (*C. A.* 23, 3100) contrary to the opinion of Filippov and Gross (*Naturwissenschaften* 17, 121(1929)). Reply A. FILIPPOV AND E. GROSS. *Ibid* 364.

B. J. C. VAN DER HOEVEN

The intensity of secondary scattered radiation (Raman lines). C. MANNEBACK. *Naturwissenschaften* 17, 364 5(1929).—It is shown that *a priori* no direct relation need exist between the intensity of Raman radiation and that of ultra red absorption lines of a substance. For diatomic mols. the intensity of the secondary Raman light and of the primary Tyndall scattered radiation are in the ratio of ν_2 to ν_1 with ν_2 the lowest frequency of the rotation spectrum ($h \cdot 4\pi^2 I$) and ν_1 the oscillation frequency of the mol. B. J. C. VAN DER HOEVEN

Fine structures in the helium band lines. G. S. MONK AND R. S. MULLIKEN. *Nature* 124, 91(1929).—The electron levels of He₂ fall into two systems, *p*-He₂ and *o*-He₂, paralleling the *p*-He and *o*-He terms. On theoretical grounds the *o*-He₂ and *p*-He₂ levels are probably triplets and singlets like the corresponding at. levels but no evidence of triplet structure has been reported in the *o*-He₂ levels. This is not surprising since the *o*-He terms show only very narrow line structures. On photographing the He₂ bands with somewhat higher resolving power than hitherto, fine structure has been found in the lines of a no. of *o*-He₂ bands having 2π as their lower electronic state. W. F. MEGGERS

Remark on the paper "The Stark effect of second order in the Balmer series of hydrogen." H. RAUSCH VON TRAUBENBERG AND R. GEBAUER. *Naturwissenschaften* 17, 442 3(1929). cf. *C. A.* 23, 3626. Schrödinger's theory was confirmed also in the higher components of fine structure of H₅. B. J. C. VAN DER HOEVEN

The intensities of Stark-effect components of the Balmer series. W. GORDON AND R. MINKOWSKI. *Naturwissenschaften* 17, 368(1929). Of the two theories, Schrödinger's and Epstein's, the former is considered the correct one for calcn. of the Stark-effect components. B. J. C. VAN DER HOEVEN

Second order Stark effect in hydrogen. H. R. V. TRAUBENBERG AND R. GEBAUER. *Z. Physik* 56, 254 8(1929); cf. *C. A.* 22, 4370. Recalcn. shows better agreement with Schrödinger's theory. Cf. *C. A.* 23, 3626. GEORGE GLOCKLER

Raman spectra of solutions of some ionized substances. ROSCOE G. DICKINSON AND ROBERT T. DILLON. *Proc. Nat. Acad. Sci.* 15, 334 7(1929).—The strongest modified lines in the spectrum of light scattered when certain solns. contg. ions are illuminated by a Hg arc are photographed and measured. The scattering materials were K₂CO₃, KHCO₃, NaNO₃, Ca(NO₃)₂, NH₄NO₃, K₂SO₄, (NH₄)₂SO₄, NaClO₃, HClO₄, NaBrO₃ and HIO₄. It appears that the magnitude of the frequency changes is uninfluenced by the nature of the pos. ion. In all cases the spectra are characterized by one line considerably stronger than any others. For this line the frequency change is very little different for the solns. contg. the ions CO₃, HCO₃ and NO₃. Also the frequency change is substantially the same for the SO₄ as for the SO₃ ion, and the same for ClO₃ as for ClO₄, and accordingly is, in these cases, independent of the no. of O atoms associated with the central atom. Finally the frequency change correspond-

ing to the strong line decreases with increase in at. no. of the central atom of the neg. ion.

W. F. MEGGERS

The Raman effect in some organic liquids. S. VENKATESWARAN. *Phil. Mag.* [7], 7, 597-600(1929).—The infra-red frequencies of acetic, propionic and butyric acids have been measured from the Raman lines. The values for acetic and butyric acids agree closely with those obtained by Coblenz and Weniger (cf. *C. A.* 5, 21). Some characteristic frequencies were measured in the extreme infra-red region not accessible to their spectrometers. The spectrum of light-scattering in the 3 acids shows the presence of the modified lines and a continuous spectrum. The intensity of the latter is nearly the same in acetic and propionic acids, but is appreciably larger in butyric acid. This is probably due to the higher viscosity of butyric acid. L. H. REYERSON

A relation between Raman spectra and ultra-violet absorption. A. LANGSETH. *Nature* 124, 92(1929).—Following a suggestion by Henri, that the Raman spectra give the possibility of detg. the vibrational frequencies of the normal state, a comparison was made of the ultra-violet absorption and Raman spectra of chlorobenzene. The absorption spectrum of chlorobenzene vapor consists of about 350 lines extending from 2780 Å. U. to 2250 Å. U. Under the assumption that the strongest band in the spectrum is due to the electronic transition from the lowest level in the normal state to the lowest level in the excited state, a general analysis of the spectrum is possible by means of the Raman frequencies.

W. F. MEGGERS

Raman effect in carbon dioxide. P. N. GHOSH AND P. C. MAHANTI. *Nature* 124, 92-3(1929).—Lines found by Rasetti in his observations on the Raman effect in CO₂ are interpreted as corresponding to an absorption band near 7.8 μ . These modified lines show that the model of CO₂ is a linear one as considered by Eucken, who has calcd. the frequency corresponding to the vibration along the direction joining the C and O atoms to be that of an unharmonic oscillator having a frequency corresponding to 7.86 μ .

W. F. MEGGERS

Raman spectra of *p*-, *o*- and *m*-xylenes. (MLE.) W. CZAPSKA. *Compt. rend.* 189, 32-3(1929).—In order to det. if the position of a group of atoms in a mol. exerts any influence on its proper frequencies, the Raman spectra of certain isomeric compds. have been studied, in particularly *p*-, *m*- and *o*-xylene. It is seen that the Raman spectra are in general not the same for the 3 xylenes studied; but the frequencies 1373 and 2918 are common to all of them and 1180 is common to *p*- and *m*-, while 723 and 734 are assumed to be identical for *m*- and *o*-. It is concluded that the position of groups in the mol. exercises an influence on the proper frequencies of certain groups but leaves those of others unaltered.

W. F. MEGGERS

Raman effect in carbon disulfide. A. S. GAVESAN AND S. VENKATESWARAN. *Nature* 124, 57(1929).—Two prominent Raman frequency shifts of 655 and 800 are found in liquid CS₂ corresponding to infra-red wave lengths 15.27 μ and 12.50 μ . None of the known infra-red bands of CS₂ in the region 2 μ to 15 μ is represented in the Raman spectrum. The Raman line corresponding to the shift 655 has an anti-Stokes line of intensity less than 1/10 of the pos. line, while the Boltzman expression requires an intensity ratio of 1/20.

W. WEST

Influence of temperature on Raman lines. Y. FUJIOKA. *Nature* 124, 11(1929).—Certain Raman lines, especially doublets in org. liquids, become diffuse with increasing temp. This may be due to increased rotation of the mols.

W. WEST

The Raman effect on isomeric organic substances. A. DADIEU AND K. W. F. KOHLRAUSCH. *Naturwissenschaften* 17, 366-7(1929); cf. *C. A.* 23, 4621.—Several org. substances of isomeric nature were compared as to their Raman effect; the intensity of Raman lines vs. wave nos. (up to 3200) are plotted for BuOH, AcOEt, ProH, Et formate, AcOMe, PhH, PhMe and *o*- and *p*-xylene. The spectra of homologous substances are more nearly alike than those of pseudo isomers; for the aromatic isomers (xylenes) the difference is considerable, specially around wave no. 1400. Many of the infra-red lines are not represented in the Raman spectrum (between 2800 and 1800 per cm.).

B. J. C. VAN DER HOEVEN

The Raman effect in water. A. DADIEU AND K. W. F. KOHLRAUSCH. *Naturwissenschaften* 17, 625-6(1929).—The mean value of the diffuse band characteristic for the Raman effect in H₂O so far detd. is 3338 per cm. The detn. was repeated with app. described previously (*C. A.* 23, 4621) on H₂O thrice distd. at 20°, 0.03 mm. spectrograph width, 7 hrs.' exposure. It gave at ν_1' = 23,990, 21,370 and 19,420 a broad diffuse and double band. The mean frequency shift derived from this is 3149 per cm. From similarity with the aromatic CH bond of energy 101 cal. per mol. it is concluded that the OH bond requires 129 cal. per mol.

B. J. C. VAN DER HOEVEN

The isoelectric point of coproporphyrin and its physiological significance. HER-

MANN FINK. *Naturwissenschaften* 17, 388-9(1929).—Isoelec. coproporphyrin (from yeast) has at its p_H (about 4) several crit. qualities; the light emission in short wave light is minimal; the fluorescence spectrum is intermediate between the acid and the alk. type, likewise the absorption spectrum. Copro-yeast contains 70 to 80% of the coproporphyrin in loose adsorptive bond; it can be removed by elution causing the fluorescence of the cells to disappear. This process takes place in neutral or weakly alk. soln. At the isoelec. point yeast cells absorb the substance even in dilns. of $1:10^7$. Dead cells become thereby red fluorescent; live cells only absorb on the surface and do not acquire fluorescence.

B. J. C. VAN DER HOEVEN

Absorption spectra of alkali halide phosphors at high temperatures. M. FORRÓ. *Z. Physik* 56, 534-43(1929); cf. A. MacMahon, *C. A.* 23, 766.

G. G.

Polarization of thallium fluorescence. R. GULKE. *Z. Physik* 56, 524-33(1929).

GEORGE GLOCKLER

Fluorescence of dyes by Wood's light. A. SEYEWETH AND J. BLANC. *Compt. rend.* 188, 714-5(1929).—Principal dyes have been subjected to Wood's light. The dyes were in powder, in soln. with various solvents, and fixed on textile fibers. A Gallois (type H) Hg lamp, in connection with a Wood's glass filter, was used to produce ultra-violet radiation. An intense band at 3650 Å. U., and weak bands at 3500 and 3700 were produced. Powder produced weak or no fluorescence. Dyes which possess in aq. or aq.-alc. soln. a characteristic fluorescence are classified. Fluorescence of the dyed fiber is perceptible. Solns. used to remove color can be utilized to characterize fluorescent coloring matters. The observations do not constitute an analytical method, but furnish a comparison with known types.

L. D. ROBERTS

The duration of fluorescence of solid uranyl salts and their solutions. R. DELORME AND F. PERRIN. *J. phys. radium* 10, 177-86(1929).—Uranyl salts and certain of their solns., excited by blue light, exhibit enduring green fluorescence, which decays exponentially: $I = I_0 e^{-t/\tau}$. The quantity, τ , representing the av. life of the mols. in the excited state, has been detd. at ordinary temp., and at that of liquid air. The measurements were made on solid salts and on solns. in H_2SO_4 and HPO_3 . The fluorescence of the solns. has a duration of the same order as that of the crystals. Conclusion: the luminescence of uranyl salts is a simple fluorescence of long duration, due to spontaneous shifting between the normal state and a state of almost metastable electronic activation of the group UO_2 .

I. J. PATTON

The mechanism of phosphorescence. RUDOLF TOMASCHEK. *Sitzb. Ges. Beförderung ges. Naturw. Marburg* 63, 119-36(1928); cf. *C. A.* 22, 1280; 23, 4621.—In accordance with his previous exptl. work, T. supposes that the phosphorescence center is built up of two essentially diff. parts which are more or less loosely bound together viz., the center molecules of the main compd. and the light-complex (the added heavy metal or organic compd. as a whole). Since various phosphores show an internal photoelec. effect, this must be due to a distortion of the mol. field, which in turn causes a loosening of the valence fields. The presence of the added foreign mols. is only effective in loosening the valence fields of the main substance, and thus render it accessible to the longer photoelec. waves. The energy is stored as exciting energy by the loosened center mols. As a result of thermal agitation, an excited center atom may collide with a light-complex in a collision of the second kind, and, if the collision is effective, this latter will become excited and emit its characteristic spectrum. No quant. calcns. are possible at present, but qual. explanations of a number of phenomena are possible. Thus the fact that when the amt. of heavy metal exceeds the normal value, the total light remains const., while the duration of phosphorescence decreases, is explained on the basis that the total light emitted depends only on the center mols., and reaches a max. only when several center mols. are bound to one light-complex. When the heavy metal concn. is increased so that several light-complexes are attached to one center mol. the probability of an effective collision is increased, thus decreasing the time of duration of the phosphorescence. The theory may be used to explain the appearance of the Na-D lines in the phosphorescence of a CaS-Sm phosphore at a temp. above that at which the Sm spectrum has long ceased to appear. The catalytic oxidation of amino acids by the use of a ZnS-Cu phosphore can also be explained by its use.

I. J. PATTON

Light emission from the phosphorescent flames of ether, acetaldehyde, propionaldehyde and hexane. HARRY J. EMELEUS. *J. Chem. Soc.* 1929, 1733-9; cf. *C. A.* 21, 1225.—By means of the previously described app., the following temps. were observed in the luminous zone: AcH 220-50°, EtCHO 290-310°, C_6H_{14} 300-60°. In each case the luminosity became noticeable in the form of pulses as the SiO_2 tube was gradually heated and then gave place to a steady bluish white glow. At higher temps. intermittent

flashes of blue flame passed down the tube. The steady glow was observed over a temp. range of approx. 100° and could be maintained without difficulty during the long periods needed to give satisfactory photographs. The phosphorescent flames of the 3 compds. all gave the same band spectrum, consisting of a series of bands degraded towards the red between 5000 and 3360 A. U. The spectrum was identical with that previously described for the phosphorescent Et_2O flame. This spectrum does not correspond with any hitherto recorded system assocd. with C. There is a certain correspondence with the "blue bands" described by Marsh (C. A. 18, 21) in the Tesla spectra of a no. of org. compds but this is not sufficient to establish the identity. The vapor pressure of AcH from -97° to 0° , for Et_2O from -65° to 0° and for EtCHO from -55° to 0° are reported. AcH is not completely oxidized in its phosphorescent flame; AcH is formed in the combustion of Et_2O but not in that of EtCHO and C_6H_{14} . The evidence appears to indicate that AcH is not an essential intermediate concerned with the light emission in these reactions.

C. J. WEST

Preparation of phosphorescent zinc sulfide. R. COUSTAL AND F. PREVET. *Compt. rend.* 188, 703 5(1929).—An intimate mixt. of Zn and S is exploded. Other substances have been incorporated in the mixt before explosion. I_2 and P are effective for actinic rays. The sulfide is composed of wurtzite crystals entangled and forming a spongy mass. The Zn must be an impalpable powder. The mixt. should contain 1.5 to 2 g. of Zn per gram of S (not an excess of Zn). Most metals lessen the persistence. Cu and U were beneficial. Fluorescent ZnSe was prepd. It was not phosphorescent.

L. D. ROBERTS

The thermophosphorescent radiations of hiddenite and kunzite. OTTO STUHLMAN, JR. *J. Optical Soc. Am.* 18, 365-9(1929).—Qual spectroscopic analyses of hiddenite, a silicate of Li and Al, and kunzite contg. traces of Mn, K, Ni and Zn have been made. The thermophosphorescence of hiddenite becomes noticeable at 1050° a reddish glow being emitted with a max. at 650 m μ . Kunzite shows the phenomenon at 168°K . At $210-8^{\circ}$ the color is pale green, at $265-79^{\circ}$ it is yellow, at $349-56^{\circ}$ the max. visible brightness is developed; at 380° it attains an orange hue, and finally at $370-420^{\circ}$ it loses luminescence entirely. The regions of max. emission are examined through a graded series of color filters.

H. R. MOORE

Fluorescent and phosphorescent excitation of mercury vapor by the resonance frequency and by lower frequencies. LORD RAYLEIGH. *Proc. Roy. Soc. (London)*, A125, 1 23(1929); cf. C. A. 22, 4065; 23, 1058, 2104.—The fluorescence of Hg under frequencies equal to or less than that of the resonance line λ 2537 has been studied. It is observed that complete absorption in a column of dense vapor 10 cm. long from the resonance line as far as λ 3750 and the green visual fluorescence in dense vapor with excitation beginning only at λ 3450 can be traced. In the spectrum of the fluorescence, consisting of the broad bands λ 3300 and 4850, Stokes' law is strongly violated, the fluorescence spectrum beginning at wave lengths 230 A. U. shorter than the excitation. When excitation extends over the resonance line, the fluorescence is sharply divided into core effect, excited by a range of 0.1 A. U. at the resonance line, and wing effect excited by the region beyond the at line. In examp. various effects in a moving stream of vapor (Phillip's effect) with control over the velocity of the stream it is found that the visual core and the wing effect begin to pass along the stream at lower velocities than the ultra core effect, thus sepg. the visual and ultra violet effects in space. Photographs are reproduced and discussed.

H. W. WALKER

Photodissociation of salt molecules. A. TERENIN. *Verhandel. Optical Inst. Leningrad* 4, No. 40, 27(1928); *Physik. Ber.* 9, 2219. In Russian with German summary.—Dil. vapors of diatomic salts (NaI , TlI) have been radiated with ultra-violet light. A powerful emission of certain lines of the metallic atoms has been observed. The relation of this emission to the wave length of the exciting light, the pressure of the gases present in the cell, and various other details have been investigated. The light absorption is connected with a dissocn. of the salt into an excited metallic atom and a non-excited halogen atom. Triatomic salts (HgCl_2 , HgBr_2 , HgI_2 , CdI_2 , ZnI_2 , PbI_2) have been irradiated with ultra-violet light; an intensive band emission has been observed. The band spectrum is independent of the exciting wave lengths. The phenomenon is a photodissocn. of the triatomic mols. into an excited diatomic mol. and an unexcited (or excited?) halogen atom.

A. L. HENNE

Active nitrogen. ZOLTAN BAY AND WERNER STEINER. *Z. Elektrochem.* 35, 733-8; *Naturwissenschaften* 17, 442(1929).—Spectroscopic methods have been employed to demonstrate the existence of N atoms in activated N. The concn. of N atoms, as well as the intensity of the after-glow, is proportional to the capacity of the condensed discharge. Active N with a high content of N atoms gives a very pronounced after-

glow. The decrease in the intensity of the after-glow using a milder elec. discharge is accompanied by a corresponding decrease in the intensity of the arc lines, *viz.*, the concn. of at. N. If the criteria suggested by Kaplan (cf. *C. A.* 23, 2647) as proof for the existence of metastable mols. be accepted, the concn. of metastable mols. reaches a max. when the activating discharge is not or only slightly condensed. Such a N, whose active product contains principally metastable mols., shows but a slight after-glow.

L. F. AUDRIETH

Phototropy. LYMAN CHALKLEY, JR. *Chem. Reviews* 6, 217-80(1929).—A thorough search of the literature has disclosed the existence of some 200 org. and inorg. substances which exhibit the phenomenon of phototropy; *i. e.*, the color changes induced by light are reversed in the dark. Excluding lithopone, anhyd. quinoquinoline-HCl and β -tetrachloro- α ketonaphthalene, most of the information extant is descriptive and of a qual. nature. Nevertheless certain evidence on these reversible light-induced color changes has shown that the attainment of the equil. point and the magnitude of the color change both bear a definite relation to the intensity of the light and the temp. of exposure. Investigations on solids (lead by Padoa, Senior, Stobbe and Mourelle) have shown that phototropic changes in many cases are manifested by an increased pleochromism of the crystals. Energy states have been identified with some colored and colorless states. Weigert believes that the distortion of electronic orbits within a phototropic crystal causes anomalous absorption of light.

H. R. MOORE

The photoelectromotive force in selenium. ROBERT L. HANSON. *J. Optical Soc. Am.* 18, 370-82(1929); cf. *C. A.* 22, 4378.—The max. photoelectromotive force developed by illumination of polycryst. Se with a 400-w. lamp was found to be 0.03 v. and this limit was found to be reduced to 0.005-0.10 v. by interposition of infra red filters. A study of the variables affecting the e. m. f. attained has led to the following conclusions: (1) The photoelectromotive force in a Se cell is independent of the current through the cell over a wide range and bears a linear relation to the intensity of illumination; (2) the photoelectromotive force sensitivity has a max. for the visible spectrum in the region $\lambda = 4900\mu\mu$; (3) the photoelectromotive force is not a thermal effect; (4) there is no evident relation between the photoelectromotive force and photocond.

H. R. MOORE

The connection between absorbed energy and velocity in photochemical reactions of the $I^{0.5}$ type. ARTHUR J. ALLMAND. *J. Chem. Soc.* 1929, 1557-60.—Regarding photochem. reactions of the $I^{0.5}$ type from the intensity and absorption formulations, equations are tabulated for (1) the amt. of transformation per unit time and (2) the amt. of transformation per unit time per unit absorption of energy, for layers of thickness dl and of finite thickness l of the photolyte. Among other things, these show that if ac (extinction coeff. \times concn. of absorbing reactant \times the layer thickness) is very small the quantum efficiency for any wave length is inversely proportional to (the rate of energy absorption) $^{1/2}$ only. If l is continually increased from a small value until absorption is complete (at a given wave length, incident intensity and concn.) the limiting value of γ in very thick layers is double that in the thin. A method for detg. the absorbed energy in the $I^{0.5}$ type of photochem. reactions is indicated.

J. B.

The photolysis of potassium ferrioxalate solutions. I. Experimental. II. Discussion. ARTHUR J. ALLMAND AND WALTER W. WEBB. *J. Chem. Soc.* 1929, 1518-31, 1531-7. The energetics of the decompn. by light, from a quartz-Hg lamp, of $K_3Fe(C_2O_4)_3$ (I) is studied. Preliminary insolations show that if sufficient $K_2C_2O_4$ be present in the I soln, pptn. of FeC_2O_4 is prevented. The extinction coeffs. of I and $K_3Fe(C_2O_4)_3$ (calcd. from exptl. data using: $\log_{10} I_0/I = kcd$, where c is in mols. l. and d in cm.) and the quantum efficiencies for monochromatic light are detd. for the lines 313, 365, 405 and 436 $\mu\mu$ using the absorption cell described in *C. A.* 19, 2301. The other app. and their method of use are given in *C. A.* 22, 1281. For I, k increases rapidly with decrease in the wave length of the light, while for $K_3Fe(C_2O_4)_3$ the increase is less rapid. The quantum efficiencies are of the order of 1, decreasing with increasing wave length. Between 0.02 and 0.06 M , γ is independent of the I concn., and for 0.02 M is also independent of the degree of decompn. between 3.42 and 32.1%. The addn. of $K_2C_2O_4$ in excess causes γ to decrease slightly, but all other electrolytes increase it slightly. Expts. with "mixed" light (consisting of varying proportions of 2 or 3 Hg lines) show that the amt. of decompn. is 25-30% greater than that calcd. by assuming additivity. γ is independent of the intensity of the light of $\lambda = 365\mu\mu$ contg. $\lambda = 405\mu\mu$ over a range of 15:1, whether continuous or intermittent. The sp. photochem. effects of intermittent and continuous light are the same. Theories interpreting the results are given.

J. BALOZIAN

Some chemical phenomena connected with the contraction of hydrogen in dis-

charge tubes. RENE DELAPLACE. *Compt. rend.* **188**, 708-10(1929); cf. *C. A.* **22**, 4378.—Contraction of H_2 can be explained without assuming the formation of H_2 . Cathode rays liberate gases from the glass. Reduction of oxides by H_2 causes a contraction of H_2 . The formation of CH_4 and CO_2 is caused by the action of the radiation on the glass. L. D. ROBERTS

Ozonization and interaction of oxygen with nitrogen under alpha radiation. S. C. LIND AND D. C. BARDWELL. *J. Am. Chem. Soc.* **51**, 2751-8(1929).—The method has been described previously by L. (*C. A.* **6**, 1709). Data are given to show the *ozone formation by ionization of O_2* . The conclusions are: (1) Ozonization in O_2 flowing past an α -ray bulb is higher (per ion pair) the greater the rate of flow and the lower the intensity of ionization. This confirms the results of D'Olieslager (*C. A.* **20**, 1760). (2) The max. yields of ozone per ion pair were not less than 1.5 and may be as high as 2-2.5. (3) Apparently, de-ozonization is the result of a secondary effect of O_2 ions (or atoms) and is not due to primary impact with an α -particle. (4) In mixts. of Na_2 and O_2 both ozone and acid forming oxides of N_2 are simultaneously formed. A small quantity of N_2O also is formed, confirming Soddy ("*Annual Report of the Chemical Society*" for 1910 **8**, 299-300(1911)). The formation of N_2O was investigated only for air. (5) The yield of acid-forming oxides diminishes as the ratio of N_2 to O_2 decreases, while the total oxidizing power toward KI soln is little influenced. L. and B. propose a theory for this. A. J. MONACK

The chemical effects of Röntgen rays. PAUL GÜNTHER. *Z. angew. Chem.* **41**, 1357-61(1928).—G. reviews the work on the chem. effects of x-rays, with especial consideration of the photographic effect, the decompn. of peroxides and the sepn. of I from solns. of iodoform in chloroform. The essential feature of the photochemistry of x-rays is the liberation of photoelectrons which then activate the reacting mols. R. L. HERSHEY

Chemical structure (ERDEY-GRUZ) 2. Existence and stability of free radicals (BURTON, INGOLD) 10. The action of ultra-violet rays on aldehydes (SIGMUND) 10.

BROGLIE, LOUIS DE: **Einführung in die Wellenmechanik.** Translated by Rudolf Peierls. Leipzig: Akad. Verlag. 221 pp. M. 11; bound, M. 13.80.

FRENKEL, ISAAK: **Einführung in die Wellenmechanik.** Berlin: J. Springer. 317 pp. M. 26; linen, M. 27.60.

Handbuch der Experimentalphysik. Edited by W. WIEN AND F. HARMS. Band 13, Teil 1. E. SCHWEIDLER: **Die Ionenleitung in Gasen.** A. BECKER: **Die elektrischen Eigenschaften der Flamme.** Leipzig: Akad. Verlag. m. b. H. 314 pp. M. 29.60. Reviewed in *Nature* **124**, 297(1929).

JOOS, GEORG: **Handbuch der Experimentalphysik. Bd. XXII. Zeemaneffekt. Ergebnisse und Anwendung der Spektroskopie. Ramaneffekt.** Leipzig: Akad. Verlag. 436 pp. M. 41; bound, M. 42.80.

Photochemical gas reactions. I. G. FARBENIND. A.-G. *Brit.* **307**, 521, Nov. 2, 1927. In effecting reactions in gases to which metallic vapor has been added, such as Hg vapor, by treatment with radiations from an elec. discharge in metallic vapor, the gas is repeatedly exposed to the radiations and the time of each exposure is limited to prevent the initiation of secondary reactions. Examples are given of the production of CH_3O from H and CO and of the production of H_2O_2 from H and O. Cf. *C. A.* **23**, 3408.

Photochemical gas reactions such as those of carbon monoxide and hydrogen. I. G. FARBENIND. A.-G. *Brit.* **307**, 406, Nov. 2, 1927. In effecting reactions by exposure of gases contg. metal vapor to the radiations from a discharge effected in metal vapor, the spectral development of the emission is adjusted in width and intensity to the capacity for absorption exhibited by the gas under treatment. Gases which are inert toward the metallic vapor or which are at low pressure can absorb only a narrow range of wave length; high-pressure gases or chemically active gases such as those contg. O can absorb broader bands of radiation. App. is described.

Measuring the intensity of radiations. I. G. FARBENIND. A.-G. *Fr.* **658**, 762, May 16, 1928. The intensity of radiations, particularly ultra-violet rays, is measured by utilizing the change of color of phototropic substances which are practically sensitive only in a spectral region identical with that to be analyzed, while establishing reproducible degrees of coloration by the addn. of measured proportions of the substances which are opposed to the photochem. change of color. Leucocyanides, carbinols or sulfurous derivs. of basic dyes may be used as the phototropic substances.

Ultra-violet ray apparatus. NICOLAS JAROTZKY. *Fr.* **659**, 400, Aug. 22, 1928.

4—ELECTROCHEMISTRY

COLIN G. FINK

The history of electricity before the discovery of the voltaic pile. C. J. BROCKMAN. *J. Chem. Education* 6, 1726-32(1929); cf. *C. A.* 23, 4412. E. J. C.

Organic electrochemistry. A. T. DANN. *Chem. Eng. Mining Rev.* 21, 444-6 (1929).—A lecture. E. J. C.

• The General Electric research laboratory. What it is and what it has accomplished. GUY BARTLETT. *J. Chem. Education* 6, 1619-29(1929). E. J. C.

Electric equipment of arc furnaces. S. SCHEV. *A. E. G. Mitt.* 1929, 522-34.—In conclusion to a paper on the fundamentals of arc furnaces (*A. E. G.* 1928, 195) individual parts of the electric equipment are described in more detail: transformers, reactance choke coil, electrode regulation, high-voltage switch and arrangement of equipment. M. McMAHON

Electric-furnace high-content manganese steel. ANON. *J. four elec.* 38, 269-70 (1929).—The details are described of prepn. of Mn steel by adding ferro-manganese directly to ordinary steel as soon as the charge is fused and alloying under initial slag. M. McMAHON

Electric furnace industries in Italy. ANON. *J. four elec.* 38, 261-2(1929).—Data are tabulated showing the important advances in use of electricity in various parts of Italy for the manuf. of cast Fe, steel, Fe alloys, Al and Zn. M. McMAHON

The electric arc furnace in the brass foundry. J. B. MEIER. *Metal Ind.* (N. Y.) 27, 215-7, 282-3; *Metal Ind.* (London) 34, 468-72(1929).—Practical melting with the elec. arc furnace in a general jobbing brass foundry is discussed, giving special emphasis to operation, maintenance, and cost. The following features, necessary for successful operation, are considered in the order of their importance: (a) charging and pouring, (b) rocking of the furnace, (c) maintenance of proper arc, (d) accurate records, (e) slag, (f) quantity charged, (g) varying mixts. and (h) operating labor. Features of maintenance and of costs are similarly subdivided and discussed. Melting losses during 3 yrs. of fuel oil firing were 3.7%, while during the last year, under 85% elec. melting and 15% fuel oil operation, the melting losses were 2.4%. Savings are also effected in labor costs and in no. of heats per crucible. W. H. BOYNTON

Electric brass melting. J. B. MEIER. *Elec. World* 94, 313-6(1929).—Operating characteristics and melting costs are discussed of two 350 lb. Detroit arc furnaces, as used in a jobbing foundry producing principally plumbing supply castings. One of these furnaces will supply 16 heats in 9½ hrs. When the number of heats required ran from 16 to 22, it was found more economical to operate oil furnaces to supply the heats above 16 as is shown in the graphs. Labor costs were as follows: for oil furnaces \$3.75 per ton; for elec. furnaces \$2.30 per ton. From 4 to 4½ lb. of electrodes per ton were consumed. Metal loss with oil furnaces was 5.7% (av. for 3 years) compared to 2.4% when production was 85% with elec. furnaces and 15% with oil furnaces. The cost per ton melted was \$13.54 for elec. operation (exclusive of metal loss) as against \$17.50 for oil. One operator takes care of 2 elec. furnaces which are placed with operating ends together. This foundry has experienced reduced costs, better control of operation and production, and better working conditions since installing elec. furnaces. A. D. SPILLMAN

Electric heating elements. EDWIN FLEISCHMANN. *J. Am. Inst. Elec. Eng.* 48, 665-8(1929).—F. points out some fundamentals used in design and presents the derivation from elementary principles of equations for the design of heating elements. These are connected with Stefan's law of radiation and with a much used rating curve with good results. The reason for the conservatism of this curve is shown and a com. example worked out for both the theoretical and empirical curves. Attention is confined to metallic resistors for high-temp. work (up to 1010°) which appears to be the upper safe limit of the operating temp. of the heating unit. The alloy used is 80% Ni and 20% Cr with practically no Fe. The derivation of fundamental equations for use in the design of elec. heating elements shows what are the phys. limitations of the problem. W. H. BOYNTON

An improved form of electric resistance furnace. W. ROSENHAIN AND W. E. PRYTHORCH. *J. Inst. Metals* 41, 27-35(1928); *Engineering* 127, 339; *Iron & Steel Con.* 12, 181-2(1929).—An elec. resistance furnace is described (Brit. patent No. 297,508) for which advantages are claimed for higher available working temps. (up to 1400°) and freedom from oxidation of the C resistor. The heating element consists of C or graphite pellets, or short rods placed end to end in a loose-fitting refractory sheath-

ing tube. Contact resistance develops the heat and the sheathing tube prevents access of air sufficiently to avoid any appreciable burning of the C. Solid end-pieces of graphite or C provide the resistor with comparatively cool ends, to which elec. contact can be made without the necessity of water cooling. A clearance of 0.4 mm. for the sheathing tube is sufficient to prevent risk of fracture and at the same time to insure but slow diffusion of gas through the narrow space. The capillary air space, at the start, and later the space filled with gases in equilibrium with the hot C is sufficient protection from the external atm. The furnace and heating elements are illustrated. A discussion is included.

The world's consumption of calcium carbide. ANON. *J. four elec.* 38, 294 5(1929).
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Periodic phenomena in electrolysis. LESLIE S. HENRI. *J. Chem. Soc.* 1929, 1028-38; cf. C. d. 22, 917.—Expts. were carried out on the anodic soln. of Cu to discover the mechanism of periodic phenomena in electrolysis. The frequency of the periods was independent of c. d. up to a certain point but above this point the frequency decreased with increase of c. d. The accumulation of Cu_2O at the electrode accounts for this change in behavior. During the first stage of electrolysis, the characteristic frequency increases linearly with the rate of rotation of the anode and with the concn. of the HCl. The periods are independent of the rate of formation of ions from the metal but are dependent upon the rate of supply of Cl ions provided to the anode. A crit. concn. of Cl ions is necessary before the anodic film can be dissolved. Reaction then goes to completion and the re-formation of the film begins. This constitutes the period of one pulse. Crit. concns. were observed for Cu rendered passive by anodic polarization in HCl and for Fe rendered passive by anodic HNO_3 . J. W. SHIPLEY

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G. I. COSTEANU. *Compt. rend.* 189, 35-7(1929).—The basic reaction in the cell described is oxidation of Zn by fused soda with liberation of H₂. H₂ reduces the CuO of the anode and causes depolarization. Operation of the battery was studied at 400°. The initial internal resistance is 1.949 ohms. M. MCMAHON

The electrolytic preparation of alloys of barium and of strontium. KENNETH W. RAY. *Metals and Alloys* 1, 112-3(1929).—Three types of app. were used: (1) A porcelain crucible of 250 cc. capacity served as the contg. vessel. In the bottom was placed about 100 g. of the metal such as Sn, to serve as the cathode, and on this was placed the salt mixt. to be electrolyzed. The anode was an arc C rod 1 cm. in diam. and 15 cm. in length. Elec. contact was made with the cathode metal by means of another arc C insulated from the salt bath by inserting it in a close fitting tube of vitreous SiO₂. (2) An app. similar to that of Jellinek and Wolff (*C. A.* 19, 3410) was used. (3) A metallic crucible contained the molten metal and fused salt. The anode was the same as above; the crucible itself served as the cathode. The best results were obtained in the prepn. of low melting alloys by the electrolysis of a mixt. of the alkali and the alkali earth chlorides. Alloys of Ba and Sr with the following metals have been prepd.: Sn, Zn, Cd, Bi, Sb and Al. Attempts to produce a Ba-Cu alloy have met with very little success. A high c. d. (12-20 amp with cathode surface of 12-15 sq. cm.) was employed. The current efficiencies were high at the beginning of the electrolysis but decreased rapidly as the amt. of the alkali earth metal in the alloy increased. At high concns. of Ba and Sr the alloys became porous and spongy. Alloys with more than 27% Ba in Sb, 20% Sr in Sn, 28% Ba in Sn and 6% Ba in Bi were difficult to obtain. Alloys of Al with more than 2.3% Ba were not obtained. All of the alloys were much harder than the original metal and they possessed a higher m. p. Most of the alloys were coarsely cryst., more brittle and less malleable than the original metal, and tarnished rapidly in air. Most of them decompd. cold H₂O with the evolution of H₂. A. J. MONACK

A new method of working foundry waste by cuprous chloride electrolysis. GUNTHER HANSEL. *Die Gießerei* 16, 610-8(1929). A process developed by the firm of Siemens Halske (*C. A.* 22, 32) for the electrolytic purification of Cu or Cu alloys using an electrolyte contg. CuCl₂ is described. The feature of this process is the oxidation of the HCl-CuCl₂ soln. to CuCl₂ by blowing air or any suitable oxidizing agent through the soln. CuCl₂ reacts with Cu to form CuCl, and with the other metals to form CuCl and their resp. chlorides. A l. of the electrolyte contains 175 g. NaCl, 9-10 g. HCl and 20-30 g. Cu as CuCl. A smooth, dense deposit is obtained by the addn. of a coll. of (e. g., 0.5 l. g. l. of glue). The current yield is increased from 85-95% to ca. 98% by covering the electrolyte with a layer of paraffin oil. Advantages of this method over the CuSO₄ electrolysis are: (1) smaller consumption of chemicals and power; (2) simpler working of the residues for other metals; (3) increased Cu production per energy input. J. BALOGIAN

Refining Anaconda copper at Raritan and Great Falls. W. T. BURNS. *Eng. Mining J.* 128, 306-12(1929). A detailed description is given of the electrolytic refineries at Raritan and Great Falls covering the anode casting, electrolytic refining, casting of refined Cu, purification of electrolyte, treatment of slimes and refining of d. re. C. L. READ

French process modernized by Anaconda in production of zinc oxide at East Chicago. F. O. CARR. *Eng. Mining J.* 128, 326(1929). Electrolytic Zn is volatilized from a furnace and the vapor oxidized by a stream of air. Various grades of ZnO are produced by regulating the raw material and the mfg. cycle. C. L. READ

Pioneer work in development of white lead manufacture by Sperry electrolytic process. R. G. HOWMAN. *Eng. Mining J.* 128, 318(1929). Basic Pb carbonate is produced by an electrolytic process in which Pb anodes and Fe cathodes are used. They are sep'd. by a linen diaphragm. The electrolyte is a soln. of Na acetate and carbonate, the anolyte contg. a small quantity of the carbonate and the catholyte contg. a relatively large amt. The Pb dissolves from the anode and is immediately precip. as the basic carbonate. The concn. of carbonate in the anolyte is kept const. by transfer from the catholyte. The basic carbonate is removed from the anolyte by settling and filtration. It is then dried and pulverized. The catholyte is circulated from the cells through a CO₂ absorption tower to restore it to its original compn. C. L. READ

Electrolytic zinc practice at Great Falls and Anaconda. ALBERT E. WIGGIN AND BENJEL B. CAPLES. *Eng. Mining J.* 128, 319-24(1929); cf. Laist, *et al.*, *C. A.* 15, 804.—The electrolytic production of Zn is described with special reference to changes in the process and plant since 1921, the Great Falls plant having been increased from 200

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Batteries with fused electrolyte—copper oxide-fused caustic soda-zinc battery.

G. I. COSTEANU. *Compt. rend.* 189, 35-7(1929).—The basic reaction in the cell described is oxidation of Zn by fused soda with liberation of H. H reduces the CuO of the anode and causes depolarization. Operation of the battery was studied at 400°. The initial internal resistance is 1.949 ohms. M. McMAHON

The electrolytic preparation of alloys of barium and of strontium. KENNETH W. RAY. *Metals and Alloys* 1, 112-3(1929).—Three types of app. were used: (1) A porcelain crucible of 250 cc. capacity served as the contg. vessel. In the bottom was placed about 100 g. of the metal such as Sn, to serve as the cathode, and on this was placed the salt mixt. to be electrolyzed. The anode was an arc C rod 1 cm. in diam. and 15 cm. in length. Elec. contact was made with the cathode metal by means of another arc C insulated from the salt bath by inserting it in a close-fitting tube of vitreous SiO₂. (2) An app. similar to that of Jellinek and Wolff (*C. A.* 19, 3410) was used. (3) A metallic crucible contained the molten metal and fused salt. The anode was the same as above; the crucible itself served as the cathode. The best results were obtained in the prepn. of low-melting alloys by the electrolysis of a mixt. of the alkali and the alkali earth chlorides. Alloys of Ba and Sr with the following metals have been prepd.: Sn, Zn, Cd, Bi, Sb and Al. Attempts to produce a Ba-Cu alloy have met with very little success. A high c. d. (12-20 amp. with cathode surface of 12-15 sq. cm.) was employed. The current efficiencies were high at the beginning of the electrolysis but decreased rapidly as the amt. of the alkali earth metal in the alloy increased. At high concns. of Ba and Sr the alloys became porous and spongy. Alloys with more than 27% Ba in Sn, 20% Sr in Sn, 28% Ba in Sn and 6% Ba in Bi were difficult to obtain. Alloys of Al with more than 2-3% Ba were not obtained. All of the alloys were much harder than the original metal and they possessed a higher m. p. Most of the alloys were coarsely cryst., more brittle and less malleable than the original metal, and tarnished rapidly in air. Most of them decomp. cold H₂O with the evolution of H₂. A. J. MONACK

A new method of working foundry waste by cuprous chloride electrolysis. GÜNTHER HANSEL. *Die Giesserei* 16, 673-8(1929).—A process developed by the firm of Siemens-Halske (*C. A.* 22, 32) for the electrolytic purification of Cu or Cu alloys using an electrolyte contg. CuCl is described. The feature of this process is the oxidation of the HCl-CuCl soln. to CuCl₂ by blowing air (or any suitable oxidizing agent) through the soln. CuCl₂ reacts with Cu to form CuCl, and with the other metals to form CuCl and their resp. chlorides. A l. of the electrolyte contains 175 g. NaCl, 9-10 g. HCl and 20-30 g. Cu as CuCl. A smooth, dense deposit is obtained by the addn. of a colloid (e. g., 0.5-1 g./l. of glue). The current yield is increased from 85-95% to 97-98% by covering the electrolyte with a layer of paraffin oil. Advantages of this method over the CuSO₄ electrolysis are: (1) smaller consumption of chemicals and power; (2) simpler working of the residues for other metals; (3) increased Cu production per energy input. J. BALOZIAN

Refining Anaconda copper at Raritan and Great Falls. W. T. BURNS. *Eng. Mining J.* 128, 306-12(1929).—A detailed description is given of the electrolytic refineries at Raritan and Great Falls covering the anode casting, electrolytic refining, casting of refined Cu, purification of electrolyte, treatment of slimes and refining of doré. C. L. READ

French process modernized by Anaconda in production of zinc oxide at East Chicago. F. O. CASE. *Eng. Mining J.* 128, 326(1929).—Electrolytic Zn is volatilized from a furnace and the vapor oxidized by a stream of air. Various grades of ZnO are produced by regulating the raw material and the mfg. cycle. C. L. READ

Pioneer work in development of white lead manufacture by Sperry electrolytic process. R. G. BOWMAN. *Eng. Mining J.* 128, 318(1929).—Basic Pb carbonate is produced by an electrolytic process in which Pb anodes and Fe cathodes are used. They are sepd. by a linen diaphragm. The electrolyte is a soln. of Na acetate and carbonate, the anolyte contg. a small quantity of the carbonate and the catholyte contg. a relatively large amt. The Pb dissolves from the anode and is immediately pptd. as the basic carbonate. The concn. of carbonate in the anolyte is kept const. by transfer from the catholyte. The basic carbonate is removed from the anolyte by settling and filtration. It is then dried and pulverized. The catholyte is circulated from the cells through a CO₂ absorption tower to restore it to its original compn. C. L. READ

Electrolytic zinc practice at Great Falls and Anaconda. ALBERT E. WIGGIN AND RUSSEL B. CAPLES. *Eng. Mining J.* 128, 319-24(1929); cf. Laist, *et al.*, *C. A.* 15, 804.—The electrolytic production of Zn is described with special reference to changes in the process and plant since 1921, the Great Falls plant having been increased from 200

tons of Zn a day to 350 and the Anaconda plant having been completed in 1928 with a capacity of 175 tons a day. The introduction of selective flotation greatly increased the amt. of Zn concentrates produced in this section while the Zn content was increased and the impurities were decreased. The concentrates are roasted to 0.2% sulfide S in Wedge roasters. The calcines are put through a $\frac{1}{8}$ -in. mesh screen and are then leached in Pachuca tanks in 2 steps, spent electrolyte being used as the solvent. The residue from this leach is treated with hot spent electrolyte to decompose the Zn-Fe residue. The Fe is oxidized by means of MnO_2 and the soln. is purified by the addn. of calcine to the neutral soln., thus pptg. Fe, Si, Al, As and Sb. The Cu and Cd are removed by treating the soln. with powd. Zn. An electrolyte of high purity is required. The purified electrolyte contains 110 g. of Zn per l. and the spent electrolyte contains 105 g. of H_2SO_4 per l. The c. d. is 30 amps. per sq. ft. of cathode surface. The cathodes are stripped daily, melted and cast into 50 lb. slabs. C. L. R. British progress in electroplating in 1928. S. WERNICK. *Metal Ind.* (N. Y.) 27, 22, 82-3 (1929).

The theory of the deposition of chromium from aqueous chromic acid solutions. III. ERICH MÜLLER AND I. SHECHERBAKOV. *Z. Elektrochem.* 35, 222-31 (1929).—The cathodic current potential curves for smooth Pt and Cr in 30% soln. of specially purified CrO_3 contg. 0-10% sulfate were studied. The results are in accord with the previously published theory (C. A. 23, 2370). Pure CrO_3 cannot be reduced electrolytically with smooth Pt in spite of its strong oxidizing power. Reduction takes place only in the presence of foreign ions such as sulfate. A polarized Pt cathode does not return to its equil. potential after interruption of the current for 1 min.; i. e., it becomes covered with an invisible, nonconductive and finely porous film which inhibits the reduction of CrO_3 . In the presence of sulfate such a return takes place when the cathode potential applied reaches a certain value, i. e., when the sulfate ions penetrate and charge the cathode film due to the electrostatic force. The higher the sulfate concn., the more easily the film is penetrated. When the cathode is of Cr electroplated with Cr, the equil. potential is considerably more neg. and the film formation takes place without the aid of current in the presence of sulfate; i. e., as long as the metal is unprotected by a film, CrO_3 contg. sulfate is reduced at the surface of metallic Cr. The effects of sulfate are not detectable until a higher concn. and potential are reached; this is due to the greater density and thickness of the film produced on the Cr cathode. GUSTAF SODERBERG.

Deposition of chromium from aqueous chromic acid solutions. J. ROYNSICK. *Z. Elektrochem.* 35, 249-54 (1929).—The current efficiencies of reduction and oxidation in CrO_3 soln. were detd. by use of the gas analytic methods of Shecherbakov (C. A. 21, 3163). The anodic oxidation of the tervalent Cr ions formed by reduction at the cathode is less at Pt than at Pb anodes. The Pt anode becomes covered with a diaphragm. The portion of the current which remains for the reduction to metallic Cr after the amts. of current used for the gas evolution and for the reduction of CrO_3 to tervalent Cr have been subtracted checks with the weight of the Cr deposit only if the reduction to metallic Cr is assumed to take place from the hexavalent state. The yield of Cr does not increase with increasing concn. of tervalent Cr ions as would be expected if the reduction to metallic Cr took place from the tervalent Cr ions, as was found by Shecherbakov and Essin (C. A. 21, 3163). GUSTAF SODERBERG.

The most recent developments in chromium plating. R. JUSTH. *Metallwaren-Ind. u. Galvano-Tech.* 27, 249-51 (1929).—The metals absorb H which makes them hard and brittle and causes peeling. Subcoatings for Cr should be deposited in such a manner that they are able to absorb part of the H which is evolved during the Cr plating without becoming supersatd. Cu plate from an acid Cu bath is practically free from H and will endure a very prolonged Cr plating. Ni plate obtained at room temp. contains 2-3 times as much H as plates obtained at 45-65°. GUSTAF SODERBERG.

Chromium experiments. OLIVER J. SIZEMORE. *Metal Ind.* (N. Y.) 27, 271-2 (1929).—A series of tests on the various factors affecting the operation of Cr solns. were studied. This included the making of a Cr soln. according to a workable published formula and the effect of different variables in the operation of the soln. and the character of the work produced. W. H. BOYNTON.

Further observations concerning the form of electrolytically deposited metals. F. FOERSTER AND K. KLEMM. *Z. Elektrochem.* 35, 400-26 (1929); cf. C. A. 22, 1105. The influence of crude cresolsulfonic acid (A) upon the deposition of Sn from acid SnSO_4 solns. is due to the presence of impurities such as unchanged m-cresol and resinous condensation products, which, through their adsorption by the cathodically deposited metal, repress the tendency of Sn to form needle-like growths. This effect is specific for acid SnSO_4 solns. and does not apply to acid SnCl_2 solns. The electrolysis

of acid Cd solns. in the presence of crude (A) results in the sepn. of spongy Cd, whereas a purified (A) permits its smooth deposition in continuation of the lattice structure of the cathode and at the same time prevents deposition in a needle-like form—a tendency which is particularly strong in acid CdSO_4 solns., still stronger in NH_4 sulfate solns., and at high c. d. In accounting for this phenomenon by adsorption of substances assocd. with (A), it would seem that this tendency is much more marked with Cd, since smaller concns. of (A) are required for the smooth deposition of Cd than are necessary for Sn. Concns. of (A), satisfactory with the latter, inhibit formation of cryst. deposits of Cd. Smooth deposits are obtained where either acid chloride or acid perchlorate solns. are employed. In NH_4Cl solns. some tendency toward needle-like growths may be observed—to a lesser degree, however, than with the corresponding sulfate solns. Here again, the addn. of (A) promotes the formation of a smooth deposit. When cryst. Cd cathodes of large area are employed the cathodically deposited Cd assumes the surficial structure of the cathode. The form of the deposited Cd changes over to a fine grained structure, more readily than with Sn, when the c. d. is raised, or when the concn. of the electrolyte is lowered, or upon long-continued electrolysis. Zn and Pb are also deposited upon large cathodes of the resp. metals in accord with the surficial crystal structure. Cd, as well as Pb, may be deposited upon tin-plate following the crystal structure of the latter. (See the original article for exptl. details.)

L. F. AUDRIETH

Cadmium plating. H. C. PIERCE. *Metal Ind. (N. Y.)* 27, 373-4 (1929).—A general description of the protective value of a Cd plate against corrosion. Successful plating depends upon: the proper type of soln., means of controlling this soln., proper elec. conditions and proper handling of work. A general discussion of the best practice is included.

W. H. BOYNTON

Electrolytic deposits and coatings obtained by hot dipping. MAX SCHLÖTTER. *Metallwaren Ind. u. Galvano-Tech.* 27, 269-72 (1929).—A review of technical procedures and a discussion of factors affecting the porosity and the corrosion resistance of Zn, Sn, Pb alloys, Cd, Ni and Cr.

GUSTAF SÖDERBERG

The electrodeposition of tin. CHARLES H. PROCTOR. *Metal Ind. (N. Y.)* 27, 267-8 (1929).—Recent improvements are described in Na stannate solns. as applied to tin plating of Cu refrigerating coils, etc. The improved Sn plating soln. contains: water 1 gal. (3.79 l.), Na stannate 12 oz. (339.5 g.), Na acetate 2 oz. (56.7 g.), NaOH 1 oz. (28.3 g.), NaBO_2 $\frac{1}{4}$ oz. (3.57 g.). It is operated at 71-91°, 4-6 v. with cathode c. d. 20-60 amp. and pure Straits tin anodes. Ratio 3:1 anode to cathode. The prepn. of the soln. is outlined. For mech. barrel plating the d. of the soln. may be increased somewhat by use of larger amts. of Na salts. All com. metals and alloys may be plated with Sn from these solns.

W. H. BOYNTON

Electrodeposition of non-metallic materials. MILFORD H. CORBIN. *Metal Ind. (N. Y.)* 27, 371 (1929).—The properties and peculiarities of the deposits are briefly outlined. The most highly developed process of depositing non-metallic materials is the anode process used for electrodeposition of rubber.

W. H. BOYNTON

Repairs to Diesel engine parts by electrodeposition. C. H. FARIS. *Diesel Engine Users Assoc. (London)* 23, No. 17, 1-25 (1929).

E. I. S.

Electric galvanizing tank cuts cost one-half. ANON. *Elec. World* 94, 373 (1929).—The results of investigations on an electrically heated galvanizing tank, 3 × 5 × 3 ft., having a connected load of 70 kw. are as follows: 17,738 lb. net of steel galvanized. Economy—164 kw.-hr. per net ton (during working period) or 230 kw.-hr. per ton (including losses overnight). At the rate of 1 1/4¢ per kw.-hr., the cost of galvanizing is 14.4¢ per lb. compared to 27.5¢ per lb. with a gas-fired tank. The large saving is attributed chiefly to the reduction in immersion period from 2 min., using gas, to 45 sec., using electricity. The tank was designed for production of 800 lb. per hr. but the test shows 1000 lb. per hr. The saving due to reduction in dross is estimated at \$120.00 per month and the over-all cost is one-half the former cost with gas.

A. D. SPILLMAN

Electrolysis of water with alternating current. A. CANAUD. *Compt. rend.* 188, 1397-8 (1929); cf. C. A. 22, 2328.—Previous expts. on the electrolysis of H_2O are continued by using electrolytic Fe electrodes and introducing a paraffin coating for liquid which is taken to the b. p. by passage of current. The vol. of H obtained with solns. of sulfates of K, Na, Ca and Mg varies little. With solns. contg. H ions the vol. of H is greater; with OH ions, in Na_2CO_3 and NaOH solns., the vol. of H set free diminishes considerably; passivity of Fe in alk. medium results in more complete recombination of H and O.

M. McMAHON

Precipitation of manganese dioxide in electrolysis with alternating current. A. P. ROLLET. *Compt. rend.* 89, 34-5 (1929).—The electrolysis of Ni salt contg. small quan-

ties of Mn with a. c. gives first a deposit of $MnO_2 \cdot H_2O$ provided the temp. of the bath is below 30° and high c. d. and slightly acid bath are used. This phenomenon provides a means of detecting infinite traces of Mn in Ni salts. M. McMAHON

Experiments on the direct electrolytic preparation of some metallic permanganates. GASTON RAPIN. *Compt. rend.* 189, 287-9(1929); cf. *C. A.* 23, 775, 4894.—Ca and Ba permanganates can be prepd. directly by electrolysis of a basic soln. of metals using silico-Mn anode and Pt cathode. M. McMAHON

New type cadmium lamp. H. NAGAOKA AND Y. SUGIURA. *Sci. Papers Inst. Phys. Chem. Research (Tokyo)* 10, 263-70(1929).—The historical development of Cd lamps is reviewed with emphasis on deficiencies in previous types. The new lamp consists of a tube with a fused quartz cylinder surrounded with Mo or W wire heated by elec. current which can be taken to the temp. desired. A second fused quartz cylinder is placed above the first cylinder, suspended by a holder which has a hole permitting light to pass through a window placed at the end of the side arm. The Cd vapor is produced in this second cylinder. The luminous particles can be concd. in a second cylinder to obtain great intensity of light and the d. of Cd vapor can be controlled by heating the coil around the first cylinder. A cathode of coiled W is used to conc. electronic currents through the Cd vapors toward the Mo anode. Elec. voltage of 100 v. and electronic current of 0.3 to 4 amp. between cathode and anode are sufficient to excite Cd vapors (at 300°) and to obtain intense and stable light. The tube is constructed of double glass and is water-cooled. M. McMAHON

The elimination of residual gases in incandescent lamps. S. VOZNESENSKII. *J. angew. phys. Moskau u. Leningrad* 4, 69-74(1927); *Phys. Ber.* 9, 4. (In Russian with English summary).—Residual gases in incandescent lamps are more effectively removed by P alone than by a mixt. of red P, cryolite, nitrocellulose and amyl acetate. The unsatisfactory action of the mixt. is due to the presence of Al, because the action of the mixt. is ameliorated when cryolite is replaced by NaF. ALBERT L. HENNE

[Electrical] detection of methane. W. H. McMILLAN. *Minne Elec. Eng.* 8, 447-50, 450-1(1928); *Science Abstracts* 31B, 538 9.—Three classes of methods are available: (1) flame testers; (2) app. depending on the variation in d. of gases; and (3) app. in which a Pt wire or specially prepd. wire is heated by the passage of an elec. current. The first 2 are obsolescent while the third depends upon the behavior of a glowing wire in a mixt. of CH_4 and air. The functioning of several types of this class is outlined. W. H. BOYNTON

750-kw. high-voltage rectifier. I. J. KAAR. *Gen. Elec. Rev.* 32, 473 6(1929) — An illustrated description of a hot cathode Hg rectifier and of rectifying equipment is given together with performance curves for the rectifier. M. McMAHON

Hot cathode rectifier for high voltages. R. STRIGEL. *Siemens-Z.* 9, 448-52 (1929).—An illustrated description of a hot cathode rectifier is given together with two circuit hook-ups. Four possible difficulties in operation are considered: life of tube, action of mech. force on heating filament as a result of electrostatic field between anode and cathode, change of anode dimension on long heating and in case of short circuit during use. M. McMAHON

Electric precipitation of dust in drier gases. F. BLASS. *Bergbau* 42, 315 S (1929).—The application of the Cottrell-Mueller pptn. method to flue gas and steam driers and to driers operated with heat resulting from pulverizing processes is discussed and the equipment and installations of Lurgi Co., Frankfurt, are described. E. I. S.

Refractory formers for electric heating elements (COOPER) 19. Ag in chemistry and pharmacy (DYSON) 2. Poisoning from Cd plate (DUBERNELL) 12. Electrophoretic deposition of rubber (Brit. pat. 307,585) 30. Treating Fe pyrites (Brit. pats. 307,188 and 307,190) 9. Pb alloys for sheathing electric cables (Brit. pat. 307,543) 9. Purifying gases from blast furnaces (U. S. pat. 1,728,130) 9. Thermostatic and electric control system for electrically heated apparatus (U. S. pat. 1,728,802) 1. Cause and prevention of corrosion of transformer cooling coils (EICHORN) 14.

Electric battery. G. FERRABINO. Brit. 307,050, March 3, 1928. A cell is described having a cathode of graphite mixed with K persulfate, and an anode of Zn immersed in a soln. of $ZnSO_4$ or of Mg in $MgSO_4$. Various other salts such as sol. chromates and dichromates also may be added to the electrolyte.

Electric batteries. SCHMID-PATENT CORP. Fr. 659,715, June 30, 1928. The material of the cathode to be consumed is composed of Al and the fluid electrolyte contains substances capable of depolarizing the anode and maintaining the surface of the

cathode active, *e. g.*, it may contain 1 part of a satd. soln. of NaClO_3 to 2.6 parts of a soln. of 50% H_2SO_4 and a little dichromate. Cf. *C. A.* 23, 1576.

Dry cell electric battery. SECONDO L. CASELLA (to Bond Electric Corp.). U. S. 1,726,540, Sept. 3. Structural features.

Reversible secondary electric battery. ANDRÉ HELBRONNER and ERIC DUTT. Fr. 34,419, Oct. 11, 1927. Addn. to 650,923 (*C. A.* 23, 3172). A reversible secondary battery using as depolarizer an insol. ferricyanide and as cathode an element (Zn, etc.) high in the electrochem. series.

Storage battery. ACCUMULATOREN-FABRIK A.-G. Brit. 306,895, Feb. 27, 1928. Structural features.

Storage battery. RAYMOND A. KLOCK (to Gould Storage Battery Co.). U. S. 1,727,887, Sept. 10.

Storage batteries. EUGÈNE DROUILLY. Fr. 659,490, Dec. 17, 1927. The active metal is incorporated in the state of powder as fine as possible in a conducting and porous support which is resistant to the action of the electrolyte.

Storage batteries. PATRICE HEROULT and ANDRÉ FREUDENBERG. Fr. 650,666, Dec. 19, 1927. Polar plates having a large surface but little weight are composed of fine powder on a support such as paper. Elec. contact is obtained between the 2 layers by granules of metal piercing the paper at different parts.

Storage batteries. SOC. DE L'ACCUMULATEUR FULMEN. Fr. 659,787, Aug. 30, 1928. Method of regulating level of liquid.

Galvanic batteries. PORSCHE ELEKTRICITÄTS-G. M. B. H. Ger. 482,062, Aug. 31, 1928. An exciter for galvanic cells of solid or liquid alkali consists of a layer of S, fat, or P on the Zn electrode.

Galvanic batteries. KURT SCHENKEL. Ger. 482,064, Dec. 10, 1927. Details of the plate electrodes.

Anode battery with sliding contacts. CARL LEHMANN and ERNST HARDTMANN. Ger. 482,063, Sept. 7, 1928.

Electric cell. W. E. KERSHAW and J. L. WOODBRIDGE. Brit. 307,452, Dec. 8, 1927. See Fr. 645,935 (*C. A.* 23, 2108).

Selenium cell. JOHN NEALE. U. S. 1,728,073, Sept. 10. A base of material such as acid glass is coated with a metal-contg. liquid medium such as "silver G" by means of a stamp of the shape of electrodes to be produced, the liquid is evapd., and the base is heated to bring it into condition in which the electrodes will tenaciously adhere but without melting, and the base and electrodes are coated with light-sensitive material.

Electric battery plate. CLARENCE W. MARSH. U. S. 1,727,552, Sept. 10.

Battery depolarizer. BRUCE K. BROWN (to C. F. Burgess Laboratories, Inc.). U. S. 1,729,416, Sept. 24. Carbon is oxidized electrolytically and the oxidized carbon is milled to increase its elec. cond.

Filling tube and gas vent for electric batteries. ACCUMULATOREN-FABRIK A.-G. Brit. 307,294, March 2, 1928.

Accumulators. JOHANN BACSA. Ger. 482,065, Aug. 2, 1927. Alkali accumulators have electrodes of NiO and CoO . The electrodes comprise an Fe core with a Ni or Co coating which is oxidized, reduced and reoxidized electrolytically until the thickness of the oxide layer is sufficient for efficient storage of electricity.

Accumulator plates. GOTTFRIED HAGEN A.-G. Ger. 482,061, Mar. 27, 1928. Addn. to 454,856. Soft Pb accumulator plates have suspending claws of a harder Pb alloy contg. Sb and Cd, or As and alkali or alk. earth metals.

Electrical conductor. VICTOR E. LEOG (to Bell Telephone Laboratories, Inc.). U. S. 1,727,550, Sept. 10. A metallic coating such as Ni is formed by fusion on one of the layers of a composite conductor such as stranded Cu and a layer of magnetic material is applied to the coating, and the materials are heat treated to improve the elec. and magnetic properties of the magnetic material.

Electric discharge devices. A. LEDERER. Brit. 306,831, Feb. 24, 1928. Devices contg. a rare gas and an alkali metal vapor (such as Ne and K) are rendered capable of operation at 110 v. or less by providing a greater pressure of the rare gas than of the metal vapor.

Bi-polar filter-press type cells for electrodeposition of metals. R. EDGEWORTH-JOHNSTONE. Brit. 307,093, Nov. 4, 1927. Structural features.

Chromic acid composition for preparing chromium electroplating solutions. C. H. HUMPHRIES (to Metals Protection Corp.). Brit. 307,061, March 3, 1928. Crude dry chromic acid which may contain some SO_3 is mixed with a reactive Ba compd such as the hydrate, chromate or carbonate up to the chem. equiv. of the sulfate present

so that when the material is dissolved in water a soln. is obtained free from sulfate or contg. only a limited predetd quantity of sulfate.

Electroplating aluminum surfaces. CARL L. BEAL (to Eastman Kodak Co.). U. S. 1,727,331, Sept. 10. The article to be plated is treated with a dil. aq. alk. bath such as NaOH, Na₂CO₃ or Na₃PO₄ without electrolysis, and is then treated as cathode in an acid dil. aq. bath such as a 5% H₂SO₄ soln. under non-oxidizing conditions, and a coating such as Zn is thereafter electrodeposited on the treated surface.

Electrolytic apparatus suitable for plating. FLOYD T. TAYLOR (to Hanson-Vak Winkle-Munning Co.). U. S. 1,727,736, Sept. 10. Structural and electrical features.

Electrolytic processes. TH. GOLDSCHMIDT, A. G. Fr. 659,921, Sept. 3, 1928. In the prepn. of difficultly sol. metallic compds. by electrolysis, sol. salts of metals such as the alk. earth metals, rare earth metals, Mg, Al, Cr, V are added to the electrolyte, which cover the cathode during electrolysis with a thin layer of oxide or hydrate acting as a diaphragm and prevent secondary reactions.

Electrolytic processes. JEAN L. ANDRIEUX. Fr. 34,495, Oct. 17, 1927. Addn. to 638,345 (C. A. 23, 46). In all electrolytic operations, particularly fractionated electrolysis, refining of metals, galvanic deposition, electrolytic cementation, fusion baths composed of boric anhydride, borax or other B compd. along with one or more other substances are used.

Prevention of overvoltage in electrolysis. RAMON MEGUIN A. G. Fr. 655,934, June 11, 1928. Cl. C. A. 23, 5862. The patent number was incorrectly given as a Ger. patent in this abstract.

Electrolytic heater suitable for vaporizing liquids. JOHN STUSZ (one half to James R. Brockman). U. S. 1,728,450, Sept. 17.

Electrolytic rectifier. CAMPBELL C. CARPENTER (to Willard Storage Battery Co.). U. S. 1,727,963, Sept. 10. Structural features.

Electrolytic rectifier. NEVIL M. HOKINS (to National Carbon Co.). U. S. 1,728,182, Sept. 17. Structural features.

Electrolytic rectifier. RALPH D. MERSHON. U. S. 1,728,091, Sept. 17. Structural features.

Electrolytic rectifier. ERNEST F. LINDEN (to Willard Storage Battery Co.). U. S. 1,729,429, Sept. 24. A film-forming electrode such as an electrode formed of Al is heated (suitably to about 200° or higher in the case of Al) prior to the formation of a film on it, in order to increase the breakdown voltage of an electrolytic cell in which the electrode is used.

Electrolyte for electrolytic rectifiers. FRANKLIN H. MACKENZIE (one-half to Munson H. Lane). U. S. 1,727,656, Sept. 10. An aq. soln. of Pb acetate and NH₄ phosphate is used with a pos. electrode of Al and a neg. electrode of Pb.

Solution for chemical rectifiers. FRED T. ROWLAND (to National Carbon Co.). U. S. 1,727,462, Sept. 10. A soln. is used contg. NH₄ citrate 42.5 and NH₄ phosphate 7.5%, with electrodes which may be formed of Al and Pb.

Extraction of metals. JULIUS HOLTS. Fr. 659,987, Dec. 21, 1927. A light metal is extd. by electrolysis from a heavier fused alloy placed at the bottom of a vat and constituting the anode. A progressively ascending contact cathode is used to which the light metal adheres and is drawn upwards in the form of a rod.

Obtaining metals from ores, slags or like materials. RICHARD RODRIAN. U. S. 1,728,735, Sept. 17. The material is electrolyzed in contact with a cathode, and the electrolyzed material is treated with a hot alkali sulfide soln. to remove the metals as compds. from the residue, the hot alkali sulfide soln. contg. the metals is sepd. from the non-metal residue, cooled and metals are recovered from the soln.

Electric furnaces. THADDEUS F. BAILEY. Fr. 658,551, July 16, 1928. Arrangement of electrode is described.

Electric furnaces. JOHN J. NAYLOR. Fr. 658,637, Aug. 6, 1928. Construction of electrode is given.

Electric furnaces. SIEMENS & HUMBOLDT A. G. Fr. 658,955, Aug. 13, 1928.

Electric induction furnace. N. K. JONES and METROPOLITAN-VICKERS ELECTRICAL CO. LTD. Brit. 307,007, Feb. 23, 1928. Structural features.

Electric induction furnace. HIESCH, KUPFER and MESSINGWERKE A.-G. Brit. 307,014, March 2, 1928. Structural features.

Electric induction furnace. EDWIN F. NORTHRUP. Fr. 658,803, Aug. 1, 1928.

Electric resistance furnace. R. M. CHERRY (to British Thomson-Houston Co., Ltd.). Brit. 307,031, March 1, 1928. Resistance elements of Ni-Cr alloy are used and various structural features are described.

Electric resistance furnace for annealing. P. MENE. Brit. 306,969, Feb. 29, 1928. Structural features.

Electric resistance-heated furnace. HARRY A. FRIETCHEN (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,752, Sept. 17. Structural features.

Electric resistance-heated furnace for heating metal articles in a non-oxidizing atmosphere. H. O. BREAKER. Brit. 307,301, March 3, 1928. Structural features.

Vacuum electric furnace. MANUFACTURE D'APPAREILLAGE SCIENTIFIQUE POUR L'IND. Fr. 650,600, Dec. 19, 1927.

Electric furnace for the manufacture of phosphorus. SOCIETÀ ELETTRICA DELL' ARSA. Fr. 658,678, Aug. 7, 1928.

High-tension arc electric furnaces. AKTIESELSKAPET NORSK STAAL (ELEKTRISK-GAS-REDUKTION). Fr. 658,952, Aug. 13, 1928.

Electrode mounting for electric furnaces. PAUL L. J. MIGUET (to Soc. Electro-metallurgique de Montricher). U. S. 1,728,070, Sept. 10. Structural features. U. S. 1,728,071 also relates to structural features of elec. furnace electrodes formed in superposed sections.

Electric precipitators for phosphoric acid from fusion furnaces. SOC. DES PHOSPHATES TUNISIENS. Fr. 658,771, June 11, 1928.

Treating gaseous reaction products from electric arc treatments. OTTO EISENHUT (to I. G. Farbenind. A. G.). U. S. 1,726,547, Sept. 3. In effecting reactions such as production of C_2H_2 from CH_4 in which the gas mixt. leaving the arc is formed of a zone rich in the reaction product and a zone poor in the product, one of the zones is withdrawn to effect sepn. An app. is described.

Electric-resistance heated apparatus for heating and concentrating liquids. ROBERT A. CARLTON. U. S. 1,727,584 5, Sept. 10. Structural features.

Tungsten electrode for determining hydrogen-ion concentration. JOHN R. BAYLIS (to Leeds & Northrup Co.). U. S. 1,727,094, Sept. 3.

Continuously loaded electric cables. A. R. KEMP (to Electrical Research Products, Inc.). Brit. 307,341, March 5, 1928. A submarine cable has a central Cu core with a central strand and segmental strands and the core is wound with a magnetic loading ribbon such as a Ni-Fe alloy, so as to leave an annular space which is filled with bitumen. Coverings of rubber and guttapercha are applied. Cf. C. A. 23, 1357.

Copper electric cables loaded with iron. SIEMENS & HALSKE A. G. Brit. 307,080, March 3, 1928. To avoid brittleness in the Cu conductor produced by the heating required to restore the magnetic properties of the iron loading which are lost in the whipping process, the conductor is formed of Cu deoxidized in the fused state (suitably by use of Ca).

Electric chemical vaporizer suitable for generating medicinal or other vapors. ETHEL M. ZURBRIGG. U. S. 1,728,885, Sept. 17. Structural features.

Electrical indicating system for indicating the proper proportions of materials such as fuel and air for combustion. GEORGE W. BOST (to Republic Flow Meters Co.). U. S. 1,720,500, Sept. 24.

Electric system with a photoelectric cell for operating alarms, etc. EMIL H. BOCK. U. S. 1,727,930, Sept. 10.

Luminous effects with tubes containing rarefied gases. HERMAN J. FANGER (one-third each to Edmund R. Week, Jr. and Edmund R. Week, Sr.). U. S. 1,728,234, Sept. 17. Ne or other suitable rarefied gas capable of luminescence is continuously circulated through an electrically energized tube. Details of app. are described.

Electric incandescent lamps. GENERAL ELECTRIC CO., LTD., F. J. G. VANDEN BOSCH and N. R. CAMPBELL. Brit. 306,612, Nov. 28, 1927. A small proportion of PH_3 is added to a gas filling to prevent flashing when a low gas pressure is used.

5—PHOTOGRAPHY

C. E. K. MEES

Theory of the photographic process. H. KIESER. Z. wiss. Phot. 26, 321-40 (1929).—K. gives hypotheses of the formation of the photographic latent image on the basis of the photocond. (inner photoelec. effect) combined with Einstein's equivalence law of photochem. processes. First, K. discusses the action of H_2O in the gelatin as a Br absorber. Solarisation is explained by Lüppo-Cramer's theory—that the photochemically formed Ag at the surface of the Ag halide grain is destroyed by halogen, liberated by the photolytic decompn. within the grain, that migrated to the surface. The

solarization on plates which were first fixed and then developed is caused by a coagulation of the Ag during fixation. The Clayden and Villard effects (reversal phenomena on lightning pictures and x-rays) are regarded as closely connected with solarization. They differ from solarization in that the latent image lies deeper within the grain. The regression attacks more the ripening nuclei than the photolytically formed Ag. The failure of the reciprocity law, and the intermittency effect are explained by regression. During this regression not only photolytically formed Ag is bromated but also the ripening nuclei as in solarization. The optical sensitizing with dyes is possible if the excited dye mol. excites the neighboring Br atoms in the crystal lattice. Desensitizers are substances which have electron affinity; they are not able to excite the Br atoms so that a regression with an already formed Ag atom by the liberated Br atoms takes place. The Herschel effect is explained by comparison with the solarized Ag halide grain, which has a greater number of developable nuclei within the grain than on the surface of the grain. Infra red and red light penetrate the grain and liberate electrons, which establish a regression within the grain. A no. of free electrons migrate to the surface of the grain and form in the layers with less nuclei new Ag atoms which introduce developability.

A. P. H. TRIVELLI

Studies in photography. I. The nature of sensitivity and the latent image. FRANK E. E. GERMAN and DU-KAN SHEN. *J. Phys. Chem.* 33, 864-72 (1929). Photographic sensitizers are discussed and a bibliography given. No means completely of the sensitizing effect of AgI in AgBr emulsions is given. A formula for prepg. an iodide emulsion with large range of grain size has been worked out. Microscopic study of the sensitivity of unsensitized AgI emulsion reveals that only 17% of the grains is developable. Large and small grains obtained by centrifuging such an emulsion showed identical sensitivity with the uncentrifuged emulsion, which indicates that insensitivity (of the 83% of grains) is not due to exhaustion of a sensitivity promoting material, but rather to rapid reversal.

E. P. WIGHTMAN

Quantitative investigations of some photographic effects. HANS THOMAS. *Z. physik. Chem., Abt. A*, 140, 355-78 (1929). It was shown that the amt. of photochemically formed Ag in a specially chosen Lippmann emulsion increases in the solarization region, while the density and the total amt. of developed Ag did not increase. The amt. of erythrosin adsorbed on AgBr was determined. In green light the photochemically formed Ag contained 64 Ag atoms for every erythrosin mol. Three different emulsions were bathed with (a) an optical sensitizer (brilliant green), (b) a desensitizer (pentaerythrol yellow), and (c) a halogen absorber (nitrite with KBr). It was shown that the visible blackening of these emulsions is not an after-effect of the total mass of photochemically formed Ag. The red exposure in the Herschel effect does not change the total amt. of photochemically formed Ag of the primary exposure, in spite of the fact that the visible blackening increases with the red exposure. The Herschel effect, therefore, is a change in structure and probably a change in distribution of the primarily formed Ag. To give the same blackening it is found that 2.2×10^4 quanta of red light are equiv. to 1 quantum of blue light. In the Herschel effect an av. of 10^4 quanta of red light are necessary to destroy the action of 1 quantum of blue light. The max. effect is at a wave length of 74 m μ .

A. P. H. TRIVELLI

A study of the photographic emulsion by means of x-rays. JAMES BROWNS. *Compt. rend. soc. polonaise phys.* 3, 131-50 (1927). *Physik. Ber.* 9, 501. The formation, development and fixation of the latent image were studied by the Debye-Scherrer method of x-ray spectroscopy. Density curves were measured with a Moll microphotometer. A Sieglahn Hadding tube with Cu anticathode was used as a source of rays. An ion illuminated emulsion gave the diffraction pattern of AgBr. Photographic measurements and comparison with a sample of AgBr prep'd from NaBr and AgNO₃ in the dark showed the presence of an ion lattice of the NaCl type. After the emulsion had been exposed during 2 weeks to daylight it was easy to obtain the lines corresponding to Ag crystals. The Ag could also be detected by the fact that the plates could be fixed without a development after then long exposure. After fixing, the Röntgen picture showed till more Ag lines. The pattern of illuminated developed and fixed AgBr emulsions showed the typical lattice of cryst. Ag. The dimensions of the crystal were accurately measured. The influence of the developing time (penetration of the developer) could be measured graphically with x-rays.

ALBERT L. HENSE

Bleaching action of desensitizers. LUTHER CRAMER. *Z. phys. Phot.* 26, 344-51 (1929); cf. *C. A.* 23, 2804. L.C. discovered that the reduction of the latent image in red light in the presence of desensitizers reaches a max. at a certain concn. of the desensitizer. L.C. explains this as a destruction of developable nuclei. The regenera-

tion of the Ag halide requires the presence of halogen atoms, which were kept adsorbed by the Ag halide. The desensitizer is also adsorbed. There is, therefore, an equil. between displacement and replacement by the adsorption depending on the concn. of the desensitizers and on the concn. of Brions. I. -C. describes investigations of the sensitized Herschel effect of fog and discusses the effect of the light intensity on the max. density of desensitized plates. A. P. H. TRIVELLI

Theory of the hydrogen peroxide effect of physical development and of the coloration produced by dyes and silver halides. A. STEIGMANN. *Z. wiss. Phot.* 26, 341-4 (1929). S. explains, with his theory about the degree of absorption of the reduction nuclei by the Ag halide, some actions of H_2O_2 and the phys. development of plates treated with dichromate H_2SO_4 . In connection with this, further explanations of the action of some dyes with Ag halides are given. A. P. H. TRIVELLI

Metallic reflection effects by the action of dyes on photochemically mordanted gelatin. A. REICHER. *Bull. soc. chim. Belg.* 37, 403-8 (1928). - Dichromated gelatin-coated plate, printed as in the Pinatype process, can be further dyed in a soln. of a basic dye to give a metallized image which is a negative by reflected light. Suitable pairs of dyes and concn. are prescribed. It is pointed out that an acid dye such as eosin, which is not very appreciably affected by dichromate, can be incorporated in the film, when the procedure after the first printing can be varied to give either a neg. or a pos. metallized image. R. describes some properties of the salt like substance obtained by mixing in situ solns. of acid violet and crystal violet. E. R. BULLOCK

Moving picture films. LOUIS LUDIE. *Rev. s. i.* 67, 204-30 (1929). The manuf. of films is described. P. THOMASSET

Ag in chemistry and pharmacy (LUSON) 2.

BERLEY, M. - Photographie, micro-photographie, reproduction photomécanique. Bordeaux: Librairie R. Piquot; Paris: Vigot Frères. 168 pp. F. 35. Reviewed in *Chem. & industry* 22, 139 (1929).

Proceedings of the Seventh International Congress of Photography, London, July 9-14, 1928. Edited by W. CLARK, T. SLATER PRICE and B. V. STORR. Cambridge W. Heffer and sons, Ltd. 571 pp. 25s. net. Reviewed in *Nature* 124, 369, *J. Franklin Inst.* 208, 116 (1929).

Photographic process. I. G. FARBENIND A. G. Brit. 307,512, March 10, 1928. Light-sensitive layers which yield print-out positives from negatives are produced by coating a support such as paper or a gelatin layer with a soln. of the chromate of a mono-chlorinated *p*-phenylene diamine or producing the chromate on the support by successive application to it of a soln. of a chromate or chromic acid and a diazo soln. No development is necessary and the prints are fixed merely by treatment with water.

Color photography. I. DUFAY. Brit. 307,433, Sept. 7, 1927. A screen negative which may be reversed to form a positive having green, violet and orange screen elements is reproduced upon a sensitized support having a yellow, blue and red screen, reproduction being through both screens and without pattern registration. Each of the colored elements of the positive screen passes 2 of the colors of the negative screen and stops the third color. Cf. *Ch. A.* 23, 3156.

Optical system for color cinematography. KARL MARTIN. U. S. 1,728,426, Sept.

Photographic films. K. BEATING. Brit. 307,431, March 7, 1928. A supporting layer of cellulose hydrate is secured to the gelatin side of a film after it has passed through all the baths and either before or after drying. A cellulose ester base of reduced thickness may be used or the base (such as nitrocellulose compn.) may be removed after attaching the cellulose hydrate supporting layer. Substances for reducing inflammability may be added.

Adhesive for use with photographic roll films, etc. I. G. FARBENIND A. G. Brit. 307,499, March 9, 1928. To prevent accidental uncoiling of rolls of film or the like two of the turns of film at the end are stuck together with a readily disrupted adhesive such as a 10% soln. of rubber in benzene or with tissue paper coated with such a soln. on one side and on the other with a 15% soln. of cellulose laurate in benzene.

Optical system for projection and reproduction of embossed photographic films. Soc. FRANÇAISE CINÉCHROMATIQUE. PROCÉDÉS R. BERTHON. Brit. 307,351, March 5, 1928.

Developing exposed photographic surfaces. GEORGE N. PIPER (to American

Phototure Co.). U. S. 1,728,361, Sept. 17. The surfaces are treated with atomized developing soln. An app. is described.

Photographic gelatin. WALTER DIETERLE, OTTO MATTHIES, EMIL MAUERHOFF and JOSEF REITSTÖTTER (to Agfa Ansco Corp.). U. S. 1,727,866, Sept. 10. A gelatin is prepd. contg. a degradation product of a protein such as horn shavings prepd. by subjecting the protein to hydrolysis and simultaneous partial oxidation (suitably by the action of boiling NaOH soln. and air).

Sensitized layers. KALLE & Co A-G. Fr 659,998, Sept. 5, 1928. Sensitized layers are made by applying 2 or more different diazo compds. to a support. The diazo compds. may have a different sensitiveness to light, or the same or nearly the same sensitiveness but used in different mol. proportions.

Apparatus for recording shadows cast on sensitized paper. B. HOCKEN. Brit. 307,114, Dec. 7, 1927. An app. is described which may be used with paper treated with turmeric and developed with NH_3 (in the same app. soon after exposure).

6—INORGANIC CHEMISTRY

A. R. MIDDLETON

Oxidation with fluorine. XII. Action of fluorine on nitric acid, perchloric acid and their compounds. FR. FICHTER and ERNST BRUNNER. *Helv. Chim. Acta* 12, 305-13(1929); cf. C. A. 23, 2386.—The authors discuss previous work on the action of F_2 on NaNO_2 and outline their own expts. Aq. HNO_3 was treated with gaseous F_2 with the following reaction $2\text{HNO}_3 + \text{F}_2 \rightarrow \text{N}_2\text{O}_6 + 2\text{HF}$. Tables are given showing the strength of the acid, amt. of F_2 added and amt. of HNO_3 formed in a given time. The HNO_3 decomposes on standing according to the equation $2\text{HNO}_3 = 2\text{HNO}_2 + \text{O}_2$. The action of gaseous F_2 on KClO_4 soln. is discussed and the action of F_2 on HClO_4 is explained by the equations $2\text{HClO}_4 + \text{F}_2 = \text{Cl}_2\text{O}_8 + 2\text{HF}$; $\text{Cl}_2\text{O}_8 + \text{H}_2\text{O} = \text{HClO}_4 + \text{HClO}_3$; $\text{HClO}_3 + \text{H}_2\text{O} = \text{HClO}_4 + \text{H}_2\text{O}_2$. XIII. Action of fluorine on alkali acetate solutions. *Ibid* 573-6.—A mixt. of CH_3COOK and K_2CO_3 soln. when treated with gaseous F_2 gave MeOH and HCHO . Products of the reaction were also methylene, CO_2 and H_2O . Homologs of the acetate gave similar results. K propionate and K_2CO_3 gave EtOH , AcH and C_2H_4 .

R. H. CARTER

Studies relating to boron. I. Reaction of boron trifluoride with ammonia and alkylamines. CHARLES A. KRAUS and EARL H. BROWN. *J. Am. Chem. Soc.* 51, 2690-6 (1929).—The purpose of K. and B. was to det. definitely whether or not BF_3 is capable of adding NH_3 or an amine directly without ammonolysis. The desired quantity of BF_3 dissolved in ether was satd. with NH_3 at 0° by passing a stream of NH_3 vapor over the surface of the soln. under const. agitation. Monoammino boron trifluoride ($\text{BF}_3 \cdot \text{NH}_3$) was pptd. as a fine white solid. The supernatant liquid was decanted and adhering solvent removed by means of a pump. Other means of prepn. and the properties of $\text{BF}_3 \cdot \text{NH}_3$ are discussed. Two methods of prepn. triethylammino boron trifluoride, $(\text{C}_2\text{H}_5)_3\text{N} \cdot \text{BF}_3$, 2 methods for diethylammino boron trifluoride, $\text{BF}_3 \cdot (\text{C}_2\text{H}_5)_2\text{NH}$, and 2 methods for ethylammino boron trifluoride, $\text{BF}_3 \cdot (\text{C}_2\text{H}_5)\text{NH}_2$, are given and the properties of the above are treated.

A. J. MONACK

Contributions to the study of tervalent chromium. MME N. DEMASSIEUX and J. HEYROVSKY. *J. chim. phys.* 26, 219-23(1929).—The polarographic method used for the study of the complexes of Co, Ni, U, Mn, Al, Pt and Cu has been used in the present work. Solns. of the CrCl_3 and $\text{Cr}_2(\text{SO}_4)_3$ and of the alums of K and Rb have been studied. The polarograms show a break in the curve at 0.7 v. and at 1.35 v., indicating that the electrochem. reduction of Cr^{+++} takes place in 2 stages: (1) $\text{Cr}^{+++} + 1^- \rightarrow \text{Cr}^{++}$; (2) $\text{Cr}^{+++} + 3^- \rightarrow \text{Cr}$. The addn. of acid does not exert any influence upon the deposition potential, which is a proof that the ions of H_2 do not enter into the electrolytic process, which may thus be expressed entirely by the reaction $\text{Cr}^{+++} + 1^- \rightarrow \text{Cr}^{++}$. The deposition potentials for concd. solns. of CrCl_3 deviate somewhat from the theoretical values. The explanation offered is that in the concd. solns., the hydrated CrCl_3 is the green form indicated by the formula $[\text{CrCl}_3(\text{H}_2\text{O})_4] \cdot \text{Cl} \cdot 2\text{H}_2\text{O}$, and that in the dil. solns. the violet form $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ predominates. This also indicates that it is easier to reduce the green complex than the violet complex Cr chloride. The sulfate solns. behaved similarly to the chloride solns., indicating that the complexity of the ions varied with the diln. The change in the potential for the alums of K and Rb was in close agreement and indicates that it is dependent solely upon the progressive dissocn. of the complex ion $\text{Cr}(\text{SO}_4)_2^+$ with the K^+ and Rb^+

remaining indifferent. The effect of adding the sulfate ion indicated that the concn. of the Cr^{+++} became much less. The curves for the alums show a more abrupt rise than those for the chloride or sulfate solns. A slow increase in the curve indicates that the electrochem. reaction is slow, which in turn is explained by the imperfect equil. between the green and violet modifications. No reduction is indicated in alk. solns. of trivalent chromium (chromites). This means that alk. chromite solns. are not true solns. but contain colloidal $\text{Cr}(\text{OH})_3$.

L. L. QUILL

Cobalt with a covalency of four. A new series of complex compounds. EDMUND G. V. PERCIVAL AND WM. WARDLAW. *J. Chem. Soc.* 1929, 1505-12.—A new series of compds. of the type $\text{R}_2[\text{CoCl}_4]$, $\text{R}_2[\text{CoBr}_4]$ and $\text{R}_2[\text{CoI}_4]$ ($\text{R} = \text{C}_6\text{H}_5\text{N}$, $\text{C}_6\text{H}_5\text{N}$ and $\text{C}_{10}\text{H}_{10}\text{N}$) are prepd. by adding the org. base to the Co halide in concd. HCl , HBr or HI . *Diquinolium cobaltous chloride*, $(\text{C}_6\text{H}_5\text{N})_2\text{CoCl}_4$, (m. $170-1^\circ$), is prepd. from cold satd. CoCl_2 (5 g. dried at 140°) in abs. alc. (50 cc.) satd. with HCl and from quinoline (10 g.) with stirring and cooling, as fine blue crystals, which were washed with alc. and dried in a vacuum over P_2O_5 , NaOH and CaCl_2 . It is also prepd. from quinoline- HCl and satd. CoCl_2 alc. soln. *Diquinolium cobaltous chloride monohydrate*, $(\text{C}_6\text{H}_5\text{N})_2\text{CoCl}_4 \cdot \text{H}_2\text{O}$, is prepd. from a satd. CoCl_2 (10 g.) soln. in HCl (75 cc.; d. 1.16) and quinoline (20 g.) with stirring and cooling, as blue crystals. *Dipyridinium cobaltous chloride*, $(\text{C}_5\text{H}_5\text{N})_2\text{CoCl}_4$, (m. p. $169-70^\circ$) is prepd. similarly to the first, quinoline being replaced with pyridine (7 g.), obtained as small blue crystals. *Diquinaldinium cobaltous chloride*, $(\text{C}_{10}\text{H}_{10}\text{N})_2\text{CoCl}_4$, (m. $239-40^\circ$) is prepd. by replacing pyridine with quinaldine (5 g.) in the preceding as light blue crystals. *Diquinolium cobaltous bromide*, $(\text{C}_6\text{H}_5\text{N})_2\text{CoBr}_4$, (m. $164-5^\circ$) is prepd. by adding quinoline (10 g.) to a cold satd. soln. of CoBr_2 (5 g.) in HBr (35 cc.; d. 1.5) as a bluish green cryst. ppt. *Dipyridinium cobaltous bromide*, $(\text{C}_5\text{H}_5\text{N})_2\text{CoBr}_4$, (m. $165-6^\circ$) is prepd. by adding pyridine (7 g.) to a cold satd. soln. of CoBr_2 (5 g.) in fuming HBr (25 cc.; d. 1.7) as a greenish blue cryst. ppt. *Diquinaldinium cobaltous bromide*, $(\text{C}_{10}\text{H}_{10}\text{N})_2\text{CoBr}_4$, (m. $231-2^\circ$) is prepd. by the action of quinaldine (2 g.) on a satd. soln. of CoBr_2 (2 g.) in HBr (15 cc.; d. 1.5) as a greenish blue ppt. *Diquinolium cobaltous iodide*, $(\text{C}_6\text{H}_5\text{N})_2\text{CoI}_4$, (m. $156-7^\circ$) is prepd. by adding quinoline (8 g.) to 50 cc. of cold $\text{Co}(\text{CO}_3)_2$ (10 g.) in HI (50 cc.; d. 1.7) soln. as a green cryst. ppt. *Cobaltous iodide dipyridine*, $\text{Co}(\text{C}_5\text{H}_5\text{N})_2\text{I}_2$, (m. $196-7^\circ$) is prepd. by adding pyridine (20 cc.) to 40 cc. of a cold $\text{Co}(\text{CO}_3)_2$ (10 g.)- HI (40 cc.; d. 1.7) soln. as a blue ppt. Mol. wt. and cond. detns. confirm the view that complex compds. (of the type $\text{R}_2[\text{CoX}_4]$) are formed.

J. BALOZIAN

Colors of cobaltous hydroxide. CHAS. W. STILLWELL. *J. Phys. Chem.* 33, No. 8, 1247-72 (1929).—All the colors from the interaction of cobaltous salt with KOH are shown by diagram. The conditions controlling the changes, with the microscopic evidence and x-ray diffraction patterns, lead to the conclusions that the fresh ppt. is metastable, green by transmitted light, amorphous, contg. small quantities of cryst. $\text{Co}(\text{OH})_2$ and the cryst. basic salt. The blue of the fresh ppt. is reflected color (a very small part, blue by transmitted light), a Tyndall blue scattered by crystal nuclei. The ppt. changes finally to rose, granular and cryst., a stable form, a basic salt of Co. The intermediate blue is a structural blue, mixt. of the rose and green. The change from blue to green is not due to oxidation. Adsorbed CoCl_2 and hydrous nickelous hydroxide hinder the crystal growth and decrease the rate of change.

MARY E. LEAR

Solid alkali perborates. MAX LE BLANC AND R. ZELLMANN. *Z. anorg. allgem. Chem.* 180, 127-8 (1929).—Criticism of Menzel (*C. A.* 22, 1291) on the basis of previously published work (cf. *C. A.* 17, 2400).

ALBERT L. HENNE

The affinity of aluminum for oxygen. A. DE BIRAN. *Tech. Ind. Schweiz. Chem.-Ztg.* 1929, 90-3.—The affinity of Al and O_2 , which is only surpassed by the alkali and alk. earth metals and Mg, is indicated by its high heat of formation and by the electron theory. At room temp. a transparent film of oxide, about 0.01μ thick, forms on the metal in a few days. This is resistant to chem. action, adherent and impermeable, and preserves the underlying Al. At 500° to 600° oxidation becomes noticeable, increasing rapidly with temp., while the protective action of the film is diminished. Powd. Al oxidizes rapidly, forming a liquid, and heating the air so rapidly that violent explosions may occur. This property is utilized in pyrotechnics, in aluminothermy and in reduction of metallic oxides. The action of Al powder with weak alkalies to give H_2 gas has caused unexpected fires when H_2O is used to extinguish burning Al powder. It is of practical use in the lab. prepn. of nascent H_2 and in the manuf. of porous cement. The Al_2O_3 layer is of value in Fe-Al alloys as protection from rust and in elec. app. because of its high resistance. In elec. contacts, solders and Al coatings the film may cause difficulty.

AMY LEVESCONTE

The hydration of the aluminates of calcium. I. A new crystalline form of tri-

calcium aluminate. THORBERGUR THORVALDSON and NORMAN S. GRACE. *Can. J. Research* 1, No. 1, 36-47 (1929).—Hydration of $3\text{CaO} \cdot \text{Al}_2\text{O}_3$ at room temp. or in satd. steam at 150° resulted in the formation of a cryst., isotropic hydrate $3\text{CaO} \cdot \text{SiO}_2 \cdot 6\text{H}_2\text{O}$. This is converted at $275\text{--}300^\circ$ to $3\text{CaO} \cdot \text{Al}_2\text{O}_3 \cdot 1.5\text{H}_2\text{O}$. Some water is retained up to 1000° . At about $700\text{--}800^\circ$ decomn. occurs with the formation of $5\text{CaO} \cdot 3\text{Al}_2\text{O}_3$ and CaO . Recombination takes place at $1000\text{--}1100^\circ$.
RAYMOND WILSON

Antimony phosphate. S. M. HORSCH. *Praktika (Akad. Athenon)* 2, 517; *Chem. Zentr.* 1928, II, 2632 3.— SbPO_4 was obtained by the following methods: (1) Cryst. H_3PO_4 was heated with powdered Sb at 330° . A lively reaction occurred with copious evolution of SbH_3 vapors. The temp. was allowed to rise to 370° . The mixt. was cooled, treated with H_2O and filtered. On prolonged boiling of the filtrate white crystals sepd., which corresponded to the formula $5\text{SbPO}_4 \cdot 2\text{H}_2\text{O}$. (2) Cryst. H_3PO_4 (15 mols.) was heated to 214° (at which temp. it is converted to $\text{H}_4\text{P}_2\text{O}_7$). On adding 1 mol. of SbCl_3 there occurred evolution of HCl and formation of a white ppt. A viscous mass was obtained on further heating at 320° . After cooling, the reaction product was treated with H_2O as described above. Neither method yields a pure product. The raw crystals of SbPO_4 are purified by heating in aq. NH_3 acid phosphate (10 mols. per 1 mol. SbPO_4), filtering and boiling the filtrate until 1 mol. NH_3 is evapd. Tabular crystals are obtained. The pure product is obtained also by heating 1 mol. of SbCl_3 with 11 mols. of a soln. of NH_3 acid phosphate, filtering and boiling the filtrate until it deposits pure crystals of $\text{SbPO}_4 \cdot 2\text{H}_2\text{O}$, with evolution of NH_3 . SbPO_4 is slightly sol. in H_2O and EtOH . It is not hydrolyzed on heating with H_2O .
G. SCHWOCH

The synthesis of arsenic phosphates. S. M. HORSCH and G. BETSIS. *Praktika (Akad. Athenon)* 3, 216-9; *Chem. Zentr.* 1928, II, 2632.—Arsenic phosphate. One mol. of As_2O_3 was added in small portions to $\text{H}_4\text{P}_2\text{O}_7$ (prepd. from 2 mols. of H_3PO_4 by heating at 214°). The temp. was kept at $230\text{--}45^\circ$. On further heating the mixt. solidified at 280° to a white, hard mass of microscopic needles. The substance, AsPO_4 , was purified with Ac_2O . It is fairly hygroscopic, As_2O_3 seps. when the compd. is exposed to the moisture of the air. *Combd. arsenic phosphate pyrophosphoric acid*. To 5 mols. of H_3PO_4 heated at 214° was added 1 mol. of As_2O_3 slowly and with stirring. The temp. was raised to $220\text{--}40^\circ$. At first a transparent liquid was formed, which became turbid at 250° and liquid at 300° . At 320° the mixt. solidified to a white, hard mass showing large needles under the microscope. The same compd., $4\text{AsPO}_4 \cdot 3\text{H}_4\text{P}_2\text{O}_7$, was obtained by heating 2 mols. of AsPO_4 with 3 mols. of H_3PO_4 at 320° . It is fairly hygroscopic, m. above 400° ; on cooling a vitreous mass is obtained. Treatment with Me_2CO , Ac_2O or AcOH dissolved out only $\text{H}_4\text{P}_2\text{O}_7$.
G. SCHWOCH

The reduction of permanganate by salts of manganese. M. GILLES and F. DUBOIS. *Compt. rend.* 189, 296 8 (1929).—From studies of reduction of HCl solns. contg. up to 1000 mg. Mn as MnCl_2 in 500 cc. in the presence of varying amts. of pptd. CaCO_3 at different temps. for varying lengths of time the authors conclude that the oxide formed is not MnO_2 but a *pseudo-dioxide* varying in compn., approaching but never equaling MnO_2 . A paper on the mechanism of the reaction is in prepn.
E. R. SCHIERZ

High-pressure syntheses of carbonates and silicates. W. EITEL and W. SKALIUS. *Naturwissenschaften* 17, 316-9 (1929).—The app. used for high pressure work at elevated temps. was Ruff's adaptation (C. A. 11, 3183) of Johnston and Adams' app. (C. A. 5, 2767). Several of the results obtained with carbonates and silicates are reviewed together with x-ray data on their crystal structure.
B. J. C. VAN H.

Adsorption of hydrogen by the platinum metals. ERICH MÖLLER and KURT SCHWABE. *Z. Elektrochem.* 35, 165 84 (1929). The oxides of Pt, Ru, Rh, Pd, Os and Ir have been reduced under similar conditions. The adsorption of H by the metals has been measured. Seventy-nine runs have been reported. The results have been completely tabulated.
ALBERT L. HENNE

Reactions of the halogens with carbon disulfideselenide. HENRY V. A. BRISCOE, JOHN B. PEEL and PERCY L. ROBINSON. *J. Chem. Soc.* 1929, 1048 50; cf. C. A. 23, 3180.—C disulfideselenide react: readily and exothermally with Cl and Br but not with I even in sealed tubes at 120° . Aq. solns. of the halogen acids do not react with C disulfideselenide. CSSe reacting with CCl_4 satd. with Cl gives a fine white solid $\text{SeCl}_4 \cdot \text{CSSe}$ suspended in H_2O and treated with a slow current of Cl gives a yellow oily liquid, CSCl_4 , with $d_4^{20} = 1.6996$, $d_4^{25} = 1.6923$ and surface tension at 20° , $\gamma = 35.02 \text{ dynes/cm}$, whence the mol. parachor $M\gamma^{1/3}_d = 266.1$. The value calcd. for thiocarbonyl tetrachloride is 268.5, which confirms the formula $\text{C Cl}_3\text{S Cl}$. Bromine in CCl_4 formed with CSSe hygroscopic orange-yellow crystals of SeBr_4 . These, when exposed to moist air,

formed a yellow oil. Br acting on a water suspension of CS₂Se yielded a viscous red liquid, CSBr₄, with $d_4^{20} = 3.0240$, $\gamma_{20} = 47.74 \frac{\text{dynes}}{\text{cm}}$ and mol. parachor 316.4 agreeing fairly well with the value of 323.3 calcd. for the formula CBr₃SeBr. The viscous red liquid when kept for several hours set to a solid, which crystd. from C₆H₆ and had the formula C₃S₂SeBr₄. This compd. apparently exists below 80° in both a liquid and a solid form.

J. W. SHIPLEY

A manganese dioxide-ammonium chloride reaction. C. DROTSCHMANN. Z. Elektrochem. 35, 194-8(1929).—The effects of several kinds of MnO₂ (synthetic, com.) on the behavior of a Leclanché element are described. No general conclusion is reached.

ALBERT L. HENNE

The system mercuric iodide-potassium iodide-acetone. (MISS) M. PERNOT. Compt. rend. 189, 326-8(1929); cf. C. A. 23, 2384.—The salt HgI₂·2KI found at 56° and 34° is not found at 20°; the salt HgI₂·KI· $\frac{1}{2}$ C₂H₆O exists also at 20°. M. D.

The ternary system: ammonium chloride-ammonium succinate-water. J. C. LANZING. Rec. trav. chim. 47, 901-3(1928).—The system: NH₄Cl-NH₄ succinate-H₂O was investigated at 25.2°. Probably no compd. is formed between the components.

R. L. HEKSHY

Some double compounds of the alkali carbonates with the alkaline earth carbonates. WILLY SKALIEN. Schriften Königsberger Gelehrten Ges. Naturw. Klasse 5, 93-130(1928).—Sodium calcium carbonate (I), Na₂Ca(CO₃)₂, m. 812°/1 atm CO₂, and potassium calcium carbonate (II), K₂Ca(CO₃)₂, m. 813°/1 atm. CO₂, may be prepd. by fusion of equimol. amts of the constituents in an atm. of CO₂. Thermal analysis of the system Li₂CO₃-CaCO₃ reveals the existence of a eutectic contg. 40% CaCO₃. Study of the system Li₂CO₃-Na₂CO₃ shows the compd. sodium lithium carbonate (III), NaLiCO₃, m. 514°, and 2 eutectics contg. 39% and 41% Li₂CO₃. The existence of the compd. potassium lithium carbonate (IV), KLiCO₃, m. 515°, was verified. Sodium magnesium carbonate (V), NaMg(CO₃)₂, m. 677°/1240 kg. per sq. cm. CO₂, may be prepd. (a) by the fusion of the components under a pressure of CO₂ of 1240 kg. sq. cm., or (b) by the long continued action of hot NaHCO₃ soln upon freshly pptd. MgCO₃. Potassium magnesium carbonate (VI), KMg(CO₃)₂, is obtained as a glassy solid, which, on reheating to 300° at a pressure of 40 atm. CO₂, is completely devitrified. All compds. prepd. are optically neg. and belong to the hexagonal or trigonal systems. X-ray analysis of V indicates that the unit cell contains 3 mols. and exhibits the symmetry of the type C_{3h}. IV also contains 3 mols. to the unit cell and its symmetry corresponds with either the D_{3h} or D_{3d} type. The unit cell of I contains 32 mols. and shows the symmetry of the hexagonal holo-hedral class D_{6h}. The translation group is hexagonal in every case. The morphotropic influence of the substitution of K for Na in the double Ca carbonates corresponds qualitatively to the ionic sizes of Na and K. L. F. A.

Double sulfates of the rare earth metals and the alkali metals. XII. Sulfates of cerium-ous and cesium. F. ZAMBONINI AND S. RESTAINO. Atti accad. Lincei [6], 9, 131-3(1929); cf. C. A. 22, 3853. The isotherms at 25° for the system Ce₂(SO₄)₃-Cs₂SO₄-H₂O have been detd. In this study the compd. Ce₂(SO₄)₃·Cs₂SO₄·8H₂O has been identified. It is a white, cryst. powder having pinacord structure [010].

A. W. CONTIERI

Double sulfates and their components. IV. Rhodium sulfate and its hydrates. F. KRAUSS AND H. UMBACH. Z. anorg. allgem. Chem. 180, 42-56(1929); cf. C. A. 23, 2673. Two Rh sulfates have been prepared in a pure state: a yellow and a red modification. Their analogy with the corresponding Cr sulfates has been investigated and discussed.

ALBERT L. HENNE

Hg in chemistry and pharmacy. II. The inorganic derivatives of Hg (DYSON) 2. Inorganic side of organic chemistry (KRAUS) 10. Ferric ethylate (THIESSEN, KOERNER) 10.

BILTZ, H. Experimentelle Einführung in die anorganische Chemie. Berlin and Leipzig: Walter de Gruyter & Co., 130 pp. M. 4.80. Reviewed in *Chimie & industrie* 22, 443(1929).
A. PAPINEAU-COCTURE

7—ANALYTICAL CHEMISTRY

W. T. HALL

Testing a reagent as a laboratory exercise in quantitative analysis. W. D. COLLINS. *J. Chem. Education* 6, 1550(1929). W. C. EHAUGH

Errors due to the faulty manufacture of measuring vessels used in analysis. FRIEDR. W. STEINMETZ. *Chem.-Ztg.* 53, 586(1929).—Tests of burets and flasks showed errors as great as 8.6%. The recommendation is made that graduated ware be purchased only from reputable houses. W. C. EHAUGH

Contribution to the determination of nitrogen in organic substances by Dumas method. IVAN MAREK, M. KRAJCINOVIC AND G. ZALJEV. *Bull. soc. chim.* 45, 555-60(1929).—See C. A. 23, 1365. E. C. M.

Determination of oxygen in iron by melting in vacuum. RUDGER VON SEITH. *Jernkontorets Ann.* 83, 113-50(1928).—The method is described and the results are given. Some defects of earlier papers were overcome. At the temp. necessary for the total reduction of the oxides, there is volatilization of Mn, and the subsequent condensation of Mn has an absorbing effect on the gases. By very rapid withdrawal of the gases it is probable that the mechanical absorption can be diminished. The paper is illustrated and contains a bibliography. AENE DROGSETH

Phosphorus determination in iron and steel. R. P. HENSON. *Heat Treating and Forging* 15, 995-8(1929).—Four methods used by H. in practice for detg. P in Fe and steel are detailed. J. BALOGIAN

Detection of alkaline metals in salt mixtures and silicates. N. A. FANANAEV. *Z. anorg. allgem. Chem.* 180, 77-82(1929).—Evap. the soln. to dryness and calcine slightly to remove free acid. Cover with crust $C_2O_3H_2$, then with H_2O . Evap. and calcine to decomp. the oxalates. Cool, cover with satd. $(NH_4)_2CO_3$ soln. and evap. to transform any CaO into carbonate. Treat with hot water and filter. Evap. the filtrate and calcine to change $MgCO_3$ into MgO . Treat with water and filter. Test the filtrate with litmus paper: a basic reaction indicates the presence of KOH or NaOH. Test specifically for Na (cf. C. A. 21, 1773) and K (cf. C. A. 17, 3000). If the initial salts are sulfates they should be transformed into chlorides. Sulfates must be transformed into fluorides. ALBERT L. HENSE

Detection of arsenic in lactic acid, calcium lactate and iron lactate. R. DIRTZEL AND M. SIEGERT. *Apoth. Ztg.* 44, 1049-7(1929).—A crit. review of the official German test, with the suggestion that the samples be first carefully evaporated and subsequently ashed with HNO_3 before applying the reagents Na hypophosphate soln. and $SnCl_2$ soln. W. O. E.

Spectroscopic determination of small quantities of strontium, barium and cesium in minerals, rocks, mineral waters, etc. F. ZAMBONINI AND V. CANTONI. *Atti accad. Lincei* [vi], 8, 268-73(1928).—A spectroscopic method is described by which small traces of elements (Sr, Ba, Cs) in minerals and waters may be detd. with a degree of accuracy much higher than is usually obtained. Dealing separately with solns. of the alk. earths, the effect of diln. and addn. of comparatively large quantities of the other alk. earth salts on the intensity of characteristic lines is shown, with considerable data. For the detn. of Ba and Sr the soln. must contain no free acid. B. C. A.

The analysis of stellite, akrite and similar complex alloys. E. DRUSS. *Métall. u. Erz.* 24, 537-41(1927); *Chem. Zentr.* 1928, I, 554. According to whether the alloy is readily sol. (2-3 hrs.) in HCl or not, 2 procedures are followed: (1) Boil the sample with HNO_3 after soln. in HCl (this causes the pptn. of WO_3 and filter out). Evap. the filtrate with HCl and filter off the insol. $WO_3 + SiO_2$ add to the first ppt. weigh. Purify the crude $WO_3 + SiO_2$ by fusion. Treat the filtrate from the WO_3 with H_2S to throw down Mo , filter it off, ash, again purify by HCl treatment and weigh. Ppt. Cu also by H_2S . Evap. the filtrate from the Mo detn. with H_2SO_4 to transform the remaining metals to oxides. Fuse these with Na_2O . Cr, V and Al go in soln. in H_2O , while Ni, Co, Fe and Mn remain insol. and are detd. in the usual way. (2) If insol. in HCl, fuse the alloy with $Na_2O_2 + Na_2CO_3$, which renders Si, Cr, W, V, Mo, Cu and Al sol. in H_2O while Fe, Ni, Co and Mn are insol. Work up the residue as usual. Treat the alk. soln. with strong HCl and sep. out WO_3 by boiling. Det. the other constituents as described under (1). C. R. F.

The composition of iron fluoride. ERNST DRUSSEN. *Monatsh.* 52, 107-16(1929).—Carefully prepared and dried Fe fluoride was found to be $FeF_3 \cdot 3H_2O$. L. L. QUILL

Exact rapid determination of moisture content in technical materials. M. DOLCH, E. PÖCHMÜLLER AND H. DAVID. *Chem. App.* 16, 137(1929).—The moisture content

is detd. by finding the temp. at which a mixt. of alc., water and petroleum hydrocarbons will sep. into 2 layers, one made up of the alc. and water, and the other made of the hydrocarbons. The moisture is removed from the material to be tested before the above detn. is made. Sketch and description of the app. used are given.

M. C. ROGERS

Purity tests of alkali iodides. WALTER MEYER. *Süddeut. Apoth.-Ztg.* 69, 461-2(1929).—It is shown that alkali iodides, like NH_4I , NaI and KI , after passing the usual standard tests for purity (freedom from KIO_3 and thiosulfate) often suffer decompn. with pptn. of I . A more refined method is suggested for detecting the merest traces of thiosulfate, depending on the property of this reagent in the formation of alkali iodide and tetrathionate to decolorize (I blue) a weakly acidified (H_2SO_4) soln. For titration, a 0.01 N I soln. is used.

W. O. E.

Determination of mercuric iodide by iodate reactions. FRANK G. BROCKMAN. *Am. J. Pharm.* 101, 596-601(1929).—Modified KIO_3 method. Dry about 5 g. of HgI_2 to const. wt. over H_2SO_4 , weigh accurately, transfer to a 100-cc. volumetric flask, add 50 cc. of a 5% soln. of KCN and 40 cc. of distd. H_2O , dissolve by gentle agitation, dil. accurately to 100 cc. and mix. Titrate a 10 cc. aliquot portion of the soln. contained in a 125-cc. glass stoppered bottle with 0.2 N KIO_3 , adding about half the necessary vol. at once (about 13 cc.). Then add 20 cc. HCl and 5 cc. CHCl_3 . Continue titrating, stopping and shaking the bottle thoroughly after each addn. of volumetric soln. until the color imparted to the CHCl_3 by the liberated I is just discharged. Each cc. of 0.2 N KIO_3 contains 0.01070 g. KIO_3 and corresponds to 0.2272 g. of HgI_2 .

W. G. GAESSLER

Microchemical determination of phosphate. FRIDRICH HOLTZ. *Biochem. Z.* 210, 252-60(1929). The soln., which must be free from As or Mo , is digested with a mixt. of 1 vol. concd. H_2SO_4 and 9 vols. 30% HNO_3 (sp. gr. = 1.19) to destroy org. matter and to remove Cl ions. The soln. is now dil'd. with a mixt. of 7 parts 25% NH_4NO_3 and 1 part 60% HNO_3 (sp. gr. 1.37) and heated to 100° . The pptn. is made with a molybdate reagent of the following compn.: Sixteen g. ammonium molybdate are dissolved in 100 cc. boiling H_2O , after cooling this is poured into 100 cc. 60% HNO_3 contg. 10% $(\text{NH}_4)_2\text{SO}_4$. The mixt. is digested about 5 hrs. at 60° and 12 hrs. later is filtered. It can be used so long as it remains perfectly clear. Two cc. of this reagent are used for a quantity of original material corresponding to 0.1-0.01 mg. of P . The pptn. is allowed to proceed at $60-65^\circ$ for 1 hr. The filtration of the ppt. is made 10 hrs. later through a porcelain crucible with unglazed bottom and the ppt. is washed twice with water, then with alc., once more with water and finally again with alc. The crucible is dried in an oven at $145-155^\circ$ contg. 1.2 g. $(\text{NH}_4)_2\text{CO}_3$. After cooling in a desiccator the crucibles are weighed in a microbalance. The ppt. is now dissolved in 5% NH_4OH and the crucible is washed by a regular procedure by filtration with suction, dried exactly as before and again weighed. The difference in wt. multiplied by the factor 0.01468 gives the P in mg.

S. MORGULIS

Testing acetic acid with benzidine. KURT SERKE. *Apoth.-Ztg.* 44, 1018-9(1929).—The purity of AcOH is shown by treating 5 cc. of the sample with a small quantity of benzidine, shaking and finally heating to about 60° , whereupon the soln. must remain clear and colorless.

W. O. E.

Microchemical detection of acetic acid as sodium uranyl acetate. D. KRÖGER AND E. TSCHIRCH. *Pharm. Ztg.* 74, 1096-7(1929). The test consists in the treatment of a drop of the sample on a microscope slide on one side with a crystal of Na formate, and on the other with a crystal of UO_2 formate, whereupon the almost immediate formation (depending on the concn.) of characteristic tetrahedrons will be observed. The interference of certain ions is discussed, as also a method given for prepg. UO_2 acetate.

W. O. E.

Hexamethylenetetramine, its determination. ENRIQUE F. RIBBAULT. *Z. (Farm. (Buenos Aires))* [2], 2, 340-9(1929).—Between 0.025 and 0.07 g. of $(\text{CH}_2)_6\text{N}_4$ is used, the soln. is hydrolyzed with H_2SO_4 at 100° during 5 min. in a stoppered flask. Cool and add a mixt. of a 4% soln. of CuSO_4 (20 cc.) and a soln. of 20 g. K Na tartrate and 300 g. NaOH in 1000 cc. (20 cc.). Distil off the NH_3 and det. in the usual way. Wash the $\text{Cu}(\text{O})$ in the residue and dissolve in 15 cc. of a soln. of 50 g. FeSO_4 and 200 g. H_2SO_4 in H_2O filled up to 1000 cc. Titrate the reduced Fe with KMnO_4 .

A. E. MEYER

Notes on tests for methanol. HENRY LEFFMANN AND CHARLES C. PINES. *Am. J. Pharm.* 101, 584-6(1929).—The substitution of K guaiacolsulfonate for guaiacal is a marked improvement in the test for HCHO . The test is a useful check on the fuchsin-sulfurous acid test serving especially to distinguish the glycerol from the MeOH reac-

tion, preliminary distn. seeming not to be entirely safe for such purpose. The U. S. P. process for oxidation is accurate, delicate and convenient. The tedious piecemeal addn. of powd. permanganate as directed by the Deutsches Arzneibuch is unnecessary.

W. G. GAESSLER

Microchemical determination of oxalic acid. A. LEULIER, I. VELLUZ AND H. GRIFON. *Bull. soc. chim. biol.* **11**, 46-57(1929).—Details are given for an approx. microchem. detn. of oxalic acid in solns. contg. simple org. constituents. Lime water is used as a source of Ca; phosphates do not affect the reducing power of the ppt. towards KMnO_4 . It is an advantage to add an excess of KMnO_4 in the oxidation of the Ca oxalate and to det. the excess by iodometry.

B. C. A.

Determination and separation of picric and 2,4,6-trinitrobenzoic acids. C. KRAUZ AND O. TUREK. *Chem. Obsor* **4**, 213-6(216 English) (1929).—A series of metallic salts of both acids was prepd. and the Ag salt alone found to be suitable for the sepn. Also *nitron* trinitrobenzoate has been prepd., forming needles, m. 145.6°, which, however, could not be used for the detn. in the presence of picric acid (I) as the nitron salts of both acids are insol in water. Consequently, the following method was adopted: Mix. the cold alc. soln. contg. 3-12% trinitrobenzoic acid (II) and about the same amt. of I with such a vol. of 10% AgNO_3 soln. in 80% alc. as to give at least 4 mols. of AgNO_3 for 1 mol. II present. Stir well and allow to stand 20-4 hrs. at room temp., filter, wash with 60 cc. of alc. and then with 20 cc. of ether, drv at 80° and weigh. The ppt. corresponds to 70.63% as much of II. Evap. the filtrate, add a slight excess H_2SO_4 and ext. I with ether. Dil. to a definite vol., take an aliquot part, evap. to dryness to expel HNO_3 , dissolve in hot water, filter and add nitron acetate to the hot filtrate. Wash the resulting ppt. with 60 cc. of 60% alc. and dry at 80°. The residue corresponds to 42.17% as much of II.

JAROVSLAV KUČERA

Determination of vanillin, piperonal (heliotropin) and bourbonal. J. KRITZER AND ROBERT JUNGKUNZ. *Pharm. Acta Helv.* **4**, 15 21(1929).—To detect vanillin (A) with Nickel's reagent (C. A. **22**, 1823), test the activity of the latter with an equal vol. of soln. of 2 mg. of A in 100 cc. H_2O . Upon heating on the water-bath for 15 min., a permanent wine-red color is formed. From preps. contg. A, isolate this with Et_2O before applying the test. To det. A in vanilla bean gravimetrically, use a procedure similar to that given by Eder and Schlumpf (C. A. **23**, 3989; also see P. and J. C. A. **22**, 3374), except that in place of semioxyamazid, *m*-nitrobenzohydrazid (D) (Hanus, 1905) is used. The ppt. given with the latter is more insol. than that produced with the former. The wt. of the pure compd. with $D \times 0.4829 = \text{wt. of vanillin}$. Since D is an expensive reagent, titration of A, using thymolphthalein as indicator, may be preferred. For the detn. of piperonal (B), titration cannot be used since B lacks free OH groups. To det. B by wt. in Tahiti vanilla or Guadeloupe vanillons, distil 20-25 g. cut vanilla bean with steam, collect 500 cc., supersat. with N NaOH and shake out with 3×50 cc. CHCl_3 , cover the united CHCl_3 solns. with 50 cc. H_2O contg. 0.1 g. D, distil off CHCl_3 and remove the last traces with a vacuum pump. Leave the residue for 30 min. at 60°, and after 24 hrs. filter off the flaky ppt., dry and weigh. The method recovers only 64% of B employed. Addn. of B (m. 37.0°) to A (m. 80-81°) may be recognized by a lowering of m. p. (cf. C. A. **14**, 1588). Bourbonal (C), the homolog of A, may be detd. in the same way as A by wt. and by titration. With 0.5 N KOH C turns canary yellow, B remains colorless, and A nearly so.

S. WALDBOTT

Oxidation-reduction systems of biological significance. V. The composition of the oxidized Co complex of cysteine. A colorimetric method for the microchemical analysis of Co (MICHAELIS, YAMAGUCHI) 11B. A microchemical method for the determination of K (MAZZA, ROSSI) 11B. The totyl esters of phenylacetic acid (RAIFORD, HILDEBRAND) 10.

8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY AND J. F. SCHAIRER

A new cobalt mineral. (A variety of synchrodymite). W. STAHL. *Metall u. Erz* **24**, 593(1927); *Chem. Zentr.* **1928**, I, 671.—A variety of synchrodymite is described in which a part of the Co is replaced by Cu and Fe. The crystals have the compn., Co 26.80, Ni 5.70, Cu 23.46, Fe 3.86, S 39.28, residue 0.47%; d. = 4.58.

The structure of brookite. J. H. STURDIVANT AND LINUS PAULING. *Z. Krist.* **69**, 557-9(1929); cf. C. A. **23**, 2126.—It is shown that the x-ray reflections reported by

Schröder (C. A. 22, 4413) as being incompatible with space group V_h^{16} were assigned wrong indices. When correctly interpreted, they satisfy the criteria for V_h^{15} . L. S. R.

The structure of lublinit. SOPHIE MIZGIER. *Z. Krist.* 70, 160-2(1929).—X-ray powder photographs show that calcite and lublinit (fibrous CaCO_3) have identical structures. L. S. RAMSDELL

The monoclinic soda-feldspar. TOM. BARTH. *Z. Krist.* 69, 476-81(1929).—The name barbieite has been proposed for a so-called monoclinic form of albite, isomorphous with orthoclase (C. A. 2, 3217). The finding of a similar specimen in a pegmatite from the island of Seiland, Norway, led to further study. B concludes that no monoclinic form exists, and that the material consists of sub-microscopic triclinic twinning lamellas. An analysis of the specimen gave: SiO_2 66.25, Al_2O_3 19.75, CaO 0.60, BaO 0.39, SrO 0.067, Na_2O 8.10, K_2O 4.44%. Extinction angle on (001) was 0° . L. S. RAMSDELL

A comparative x-ray study of some silicates. B. GOSSNER AND F. MUSSGUG. *Z. Krist.* 70, 171-84(1929); cf. C. A. 23, 1595. Datolite ($\text{SiO}_3\text{Ca}(\text{BO}_3)\text{H}$), enclase ($\text{SiO}_3\text{Be}(\text{AlO}_2)\text{H}$) and hemimorphite ($\text{SiO}_3\text{Zn}(\text{ZnO}_2)\text{H}_2$) all have the same no. of O atoms and nearly the same total no. of additional atoms. Datolite and enclase have quite similar structures, with 4 mols. in the unit cells, resp.: $a = 9.64$, $b = 7.62$, $c = 4.82$ A. U., space group C_{2v}^2 ; $a = 4.63$ ($1/2 \times 9.26$), $b = 14.30$ (2×7.15), $c = 4.71$ A. U., space group C_{2v}^2 . Coordinate positions are given. Hemimorphite has an entirely different structure. There are 4 mols. in the unit cell, with $a = 8.41$, $b = 5.14$ and $c = 10.73$ A. U. (the usually adopted b and c axes are interchanged to make the pseudohexagonal axis vertical). The space group is C_{2v}^2 . This structure resembles that of β -quartz; if the value of c is doubled, its unit cell becomes: $a = 8.68$ ($= b \sqrt{3}$), $b = 5.01$ and $c = 10.94$ A. U., with 12 mols. of SiO_2 . The 8 Zn atoms + 4 Si atoms of hemimorphite have an arrangement analogous to the 12 Si atoms of β -quartz, and 16 O atoms of hemimorphite correspond to 16 of the O atoms of β -quartz. There is no correlation of the remaining 8 O atoms of quartz and the 4 H_2O mols. of hemimorphite. The coordinate positions for both minerals are given. L. S. RAMSDELL

The structure of norbergite. W. H. TAYLOR AND J. WEST. *Z. Krist.* 70, 461-74 (1929). Norbergite, $\text{Mg}(\text{F}, \text{OH})_2\text{MgSiO}_4$, is the first member of the chondrodite series, which has the general formula $\text{Mg}(\text{F}, \text{OH})_2\text{MgSiO}_4$, with $n = 1, 2, 3$ and 4. Its structure agrees with that of other members of the series. There are 4 mols. in the unit cell and the space group is V_h^{16} . The O atoms (and OH or F) have an expanded hexagonal close-packed structure, with the Mg and Si atoms in the interstices. Each Si atom is surrounded by 4 O atoms, and each Mg by 4 O and 2 OH (or F). The complete data for this morphotropic series are tabulated. Like the others, norbergite consists of alternate slabs of Mg_2SiO_4 and $\text{Mg}(\text{F}, \text{OH})_2$ arranged parallel to (001). The slabs of the latter have a constant thickness for the series, while those of the former vary with the value of n . The monoclinic symmetry of chondrodite and clinohumite (with $n = 2$ and 4, resp.) is due to the lack of reflection planes parallel to (001) in the Mg_2SiO_4 slabs. L. S. RAMSDELL

The structure of staurolite. ST. NÁRAY-SZABÓ. *Z. Krist.* 71, 103-16(1929).—The data of Cardoso (C. A. 22, 2342) are closely checked, with $a = 7.82$, $b = 16.52$, $c = 5.63$ A. U. and the space group V_h^{17} . Neither the staurolite formula of Penfield nor of Horner was found acceptable. Based on the close packing of the O atoms and the relation between staurolite and cyanite, there is derived the formula $\text{H}_2\text{FeAl}_2\text{Si}_2\text{O}_{10}$. There are 4 mols. of this compn. in the unit cell. The structure is built up of the partial mols. $2\text{Al}_2\text{SiO}_5$ and $\text{Fe}(\text{OH})_2$, which are arranged in alternate slabs. If the (010) planes containing Fe and OH are removed, the remaining portion has the structure of cyanite. This explains the parallel growth of staurolite and cyanite, with their different symmetry. The variation in H_2O content shown by staurolite analyses is probably due to a tendency to change from the ideal formula with $\text{Fe}(\text{OH})_2$ to FeO . The actual crystal used for the x-ray measurements was midway between these two limits. The most common twinning plane of staurolite (032) is the (100) plane of the cubic close-packed O lattice, while the other twinning planes are also simple planes of the O lattice. L. S. RAMSDELL

The structure of cyanite. ST. NÁRAY-SZABÓ, W. H. TAYLOR AND W. W. JACKSON. *Z. Krist.* 71, 117-30(1929); cf. C. A. 22, 2003. A structure is suggested for cyanite, which is based on the structure found for the partial mol. $2\text{Al}_2\text{SiO}_5$ occurring in the staurolite unit cell. (Cf. preceding abstract.) Each Al atom is surrounded by an

octahedron of O atoms, and each Si atom by a tetrahedron of O atoms. Such independent SiO_4 groups seem to be common to all silicates in which the ratio O:Si is not less than 4:1. Not enough data are available to account for the great variation in hardness shown by cyanite in different directions. (Cf. following abstract.) L. S. R.

The structure of andalusite. W. H. TAYLOR. *Z. Krist.* 71, 205-18(1929).—The space group of andalusite is V_h^{12} . There are 4 mols. of Al_2SiO_5 in the unit cell, which has: $a = 7.76$, $b = 7.90$ and $c = 5.56$ A. U. The coordinate positions of the atoms are given. The relation between cyanite, andalusite and sillimanite can be summarized as follows: Half of the Al atoms in each are at the centers of octahedra of O atoms, which form continuous columns parallel to the c axis, and in which 2 O atoms are shared by each adjacent pair of octahedra. The Si atoms are at the centers of independent tetrahedral groups of O atoms, with no sharing of atoms by adjacent tetrahedra. The remaining Al atoms are surrounded by groups of 6, 5 and 4 O atoms in cyanite, andalusite and sillimanite, resp. This grouping of 5 O atoms in andalusite is unexpected, but seems fully verified by the data. There is no structural significance to the relation between the axial ratios of andalusite and topaz. L. S. R.

The formula of tourmaline. FELIX MACHATSKIKI. *Z. Krist.* 70, 211-33; 71, 45-6(1929).—The analyses of 56 tourmalines are tabulated. A general formula $\text{XY}_2\text{Si}_6\text{B}_3\text{H}_2\text{O}_{31}$ is suggested, in which $\text{X} = \text{Na}(+\text{K})$ and $\text{Ca}(+\text{Mn})$ and $\text{Y} = \text{Al, Ti, Fe, Mn, Mg}$ and Li . There are 3 such mols in the hexagonal unit cell. The following values were obtained: black tourmaline (Norway) $a = 16.02$ and $c = 7.22$ A. U.; rose red, (San Diego, Cal.) $a = 15.81$ and $c = 7.10$ A. U.; pale rose (Pala, Cal.) $a = 15.87$ and $c = 7.13$ A. U. This recognition, that atoms of unlike valence but like size are mutually replaceable, is important and has a bearing on the interpretation of the formulas of other complex minerals. L. S. RAMSDELL

The chemical constitution of the micas. V. The muscovite of pegmatites, pt. 2. VI. Non-pegmatitic muscovite, pt. 1. JOHANN JAKOB. *Z. Krist.* 69, 403-10, 511-5(1929); cf. *C. A.* 19, 2007; 20, 2301; 21, 3861; 23, 2394.—Analyses and optical data are given for pegmatitic muscovite from 11 localities, and analyses alone for 8 non-pegmatitic muscovites. These are all interpreted in terms of partial mols., which are characterized by radicals SiO_5SiO_2 , SiO_5SiO_2 and SiO_5SiO_2 . VII. The muscovites of pegmatites, pt. 3. *Ibid* 70, 493-6(1929).—Eight additional analyses are included in this part. L. S. RAMSDELL

The composition of a yellow radioactive mineral from Kara-Tschagyr, Ferghana. I. KURBATOV and L. IGNATOVA. *Compt. rend. sci. U. R. S. S. Ser. A*, 1928, 51-3; *Chem. Zentr.* 1928, II, 436; cf. *C. A.* 21, 3584.—The principal constituents are VO_3 , V_2O_5 , CaO , SiO_2 , Al_2O_3 besides lesser quantities of Fe_2O_3 , NiO and CuO . This very radioactive mineral would be called *Iyuyamunite* if the Ca content ran somewhat higher. C. R. FELLERS

Russian mineralogy. III. P. CHIRVIN-KII. *Z. Krist.* 70, 249-82(1929), cf. *C. A.* 22, 45.—This installment contains descriptions of Ca phosphate, phosphorite, apatite, pyromorphite, datolite, axinite, epidote, garnet, vesuvianite, gehlenite, chloritoid, delessite, hisingerite, halloysite, actinolite asbestos, feldspar, analcite, natrolite, mesolite, apophyllite, heulandite, ptilolite, stilbite, laumontite and leonhardtite. Many analyses are given, as well as complete references. L. S. RAMSDELL

Mineral resources of the United States in 1928. FRANK J. KATZ and MARTHA B. CLARK. *Bur. of Mines, Mineral Resources 1928*, Pt. I, 116 pp. (Publ. Sept., 1929). E. J. C.

Application of isopycnetric analysis to auriferous rocks. E. CLERICI. *Atti Accad. Lincei* [6], 8, 251-4(1928).—The isopycnetric method, employing liquids of d 3.03-4.19, is applicable for the sepn. of Au from auriferous rocks, and has been used successfully with minerals contg. Au particles of 2-3 μ diam. B. C. A.

The osmiridium deposits of the Adamsfield district. P. B. NYE. *Tasmania Dept. of Mines, Geol. Survey Bull. No. 39*, 70 pp.(1929).—Important con. deposits discovered in 1925 are described and their utilization is discussed. E. I. S.

The geology and mineral resources of Mi Shan and Muleng districts, Kirin. H. S. WANG. *Geol. Survey of China, Bull. No. 13*, 25-31(1929).—Coal fields extend over wide areas from short distance north of Hsia Cheng Tzu station of Chinese Eastern Railway; the total reserve is estd. at 157,000,000 tons. Au, Fe and graphite occurrences are noted. E. I. S.

The earth's important bauxite formations. HERMANN HARRASSOWITZ. *Metall u. Ers.* 24, 589(1927); *Chem. Zentr.* 1928, I, 671. —*Allite* includes rocks derived from *monohydrallite*, $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$ and *trihydrallite*, $\text{Al}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$. On account of the world-wide

need for bauxite (allite) and the const. depletion of the European monohydrallite deposits, the tropical laterite (trihydrallite) deposits will become increasingly important. The latter are richer in Al_2O_3 and contain less impurities such as Fe_2O_3 . C. R. F.

Deposition of sulfur at Monte Solfioroso near Scrofano in the province of Rome. E. ONORATO. *Atti accad. Lincei* [6], 8, 243-51 (1928).—An investigation has been made of the minerals in the old and new workings of the S mines of Monte Solfioroso. The tufa above the region of vegetation is clear reddish in color, has little coherence and is relatively acid, and probably trachitic in nature. This type contains SiO_2 47.47, Al_2O_3 23.44%. A second variety, which is perfectly white and trachitic in structure, has the high SiO_2 content of 84.43%. The transformation of the former into the siliceous type is due to the extn. of sulfates by water circulating through the deposits. Goniometric measurements have been made of the S crystals, several mm. in length, which occur in the rocks. In the abandoned workings, where water has deposited stalactites and cryst. masses of sulfates, S occurs in great masses of fibrous structure. In these deposits alum was recognized in distorted crystals, and halotrichite in a white, fibrous form of compn.: SO_3 35.10, Al_2O_3 10.61, FeO 9.10, CaO 2.33, MgO trace, H_2O 42.93%. A yellow form of halotrichite, deficient in Fe and Ca, was also recognized (SO_3 36.15, Al_2O_3 10.84, FeO 4.98, CaO trace, H_2O 46.99%). Expts. were made on the action of H_2S , SO_3 and SO_2 on the tufa, the results of which appear to support the theory that the deposits originated through the action of SO_2 emitted during the acid period in this region. B. C. A.

The origin of moldavites. J. CHLOUPEK. *Naturwissenschaften* 17, 598-600 (1929).—The work of Hanus (C. A. 23, 64) on the rare green glassy moldavites is discussed. Their origin is considered to be meteoritic. B. J. C. VAN DER HOEVEN

Helium. VI. Helium content of moldavite and artificial sorts of glass. FRITZ PANETH, KARL W. PETERSEN AND JAROSLAV CHLOUPEK. *Ber.* 62B, 801-9 (1929).—Moldavite is a vitreous mineral found in Bohemia; it belongs to the tectites. When moldavite is fused it gives a mixt. of gases rich in inert gases. The proportion of He to A and Ne is much larger than in the atm. A new detn. shows that in each cc. of atmospheric air there is 2.19×10^{-3} cc. of He + Ne. If the relative proportion of the noble gases was the same in moldavite and in the atm., the He + Ne content of moldavite could be computed by multiplying the A content by 2.35×10^{-3} . However, measurements made with 3 different samples show a He excess of 1.6×10^{-3} cc. per g. of mineral. This He excess can already be qualitatively detected by examn. of the He-Ne spectrum. The He excess is to be referred to the vitreous state of moldavite, and not to any radioactive source. It has been shown that moldavite, like ordinary com. glasses, has the property of selectively absorbing He from the atm. At about atm. pressure and room temp., vitreous materials absorb nearly 10 times more He than Ne in any given time: the excess He absorbed can reach as high as 4.2×10^{-3} cc. per g. of material. Consequently, the He content of moldavite cannot be used to det. its geological age, and the same is true for the other kinds of tectites. A. L. H.

The colored rain of October 30, 1926. EUGÈNE ROUSSEAU. *Rev. vil.* 69, 283-6 (1928).—On October 30, 1926, an ochre-colored rain fell over a considerable area of France and especially in the Yonne. Analysis of the mud from it showed: org. matter 10.65, SiO_2 41.85, Fe_2O_3 8.20, CaCO_3 13.50, CaSO_4 22.50, unidentified substances 1.9%. Among the minerals identified were quartz, calcite, complex clay stained by Fe oxide, muscovite, magnetite, anatase, rutile, tourmaline and zircon. Siliceous diatoms were present but no calcareous organisms. These data indicate the Tunisian desert as the origin of the material, which was transported by high winds. K. S. MARKLEY

The coal-ash fusion process (BUNTE, REERINK) 21. The Cu deposits of Northern Rhodesia (GRAY, PARKER) 9. HF and its applications [in analysis of fluorspar] (LEMIRE) 18. The crystal structure of the A-modification of the rare earth sesquioxides (PAULING) 2. Synthetic gems (ANGEL) 18. Precious and semi-precious stones (KUNZ) 18.

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ROCHELLEAU, W. F.: **Minerals.** Revised ed. Chicago: A. Flanagan Co. 212 pp. TYRRELL, G. W.: **The Principles of Petrology.** New York: E. P. Dutton and Co. 349 pp. \$3.25. Reviewed in *J. Franklin Inst.* 208, 440 (1929).

9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, R. H. ABORN

Progress in ore dressing and coal preparation in 1928. ROBERT H. RICHARDS AND CHARLES E. LOCKE. *Mineral Ind.* 37, 658-722(1928).—A review of crushing and grinding, screening, special processes, flotation, and principles, with examples of practice and an extensive bibliography. A BUTTS

Research as a flotation tool. H. S. GIESER. *Eng. Mining J.* 128, 465-6(1929).—Lab. flotation tests on low-grade oxidized ores at El Tigre, Sonora, Mexico, show that Na_2S effectively depresses tetrahedrite, the principal Ag-bearing sulfide mineral present. The use of org. S compds. such as alc. xanthate or "aerofloat" overcomes some of the difficulties attendant when Na_2S is used. The ideal combination has not been found but the one at present giving best results is a combination of aerofloat and Et xanthate; W. H. BOYNTON

Progress in the flotation of oxide ores and seam minerals. H. MADEL. *Metall. u. Erz.* 24, 568-71(1927); *Chem. Zentr.* 1928, 1, 742.—The prescribed method for oxide ores is conversion to sulfide by treatment with Na_2S , according to the reaction $\text{Na}_2\text{S} + \text{PbCO}_3 = \text{PbS} + \text{Na}_2\text{CO}_3$. The optimum temp. is 55° . The mixed sulfide and ore is either first roasted thoroughly and then treated with Na_2S or the ore is first floated off and then converted to sulfide. CuO ores contg. silicates cannot be treated in this way. Tin ores can be floated off with minor modifications of the process. A table showing flotation possibilities of many ores is given. C. R. FELLERS

The froth-flotation plant at the Yawata steelworks, Japan. T. IVOKU AND H. USHIO. *Fuel in Science & Practice* 8, 371-5(1929). D. A. REYNOLDS

Selective flotation of lead-zinc ores at Tooele, Utah. A. B. YOUNG AND W. J. MCKENNA. *Eng. Mining J.* 128, 291-4(1929).—Pb-Zn ores are treated on a custom basis in two 500-ton units. The ores received are of 2 general classes. Park City, generally coarsely cryst., contg. more pyrite and purer sphalerite; and Bingham, more finely disseminated, contg. more Fe, and less amenable to selective flotation. Pb, Zn and Fe concentrates are made. Thiocarbamide, xanthate and aerofloat are used as collector reagents. Addn. of reagents is governed by visual means rather than by chem. analysis. C. L. READ

Both copper and zinc ores treated by selective flotation. BAYARD S. MORROW. *Eng. Mining J.* 128, 295-300(1929).—A history of the concg. practices at Anaconda is given. The Cu ore is concd. in an alk. circuit of pH 12 to 13, xanthate being used as the collector. Screen and chem. analyses of the various products are given. The amt. of xanthate added is controlled by the amt. of Cu in the tailings. The Zn ore is treated in an alk. circuit to produce a Pb-Zn concentrate, xanthate being used as the collector. This concentrate is then treated to produce a Pb concentrate and a Zn tailing. C. L. READ

Smelting lead at Tooele. J. O. ELTON AND B. L. SACKETT. *Eng. Mining J.* 128, No. 8, 313-6(1929).—The Pb smelting operations and the plant equipment are described with respect to the roasting, sintering and smelting of the ore, dressing the bullion; converting the mat; and collecting the fume. The application of selective flotation at the Tooele custom mill has resulted in the Zn content of the furnace charge being decreased and the Pb content increased. This has simplified the smelting practice but has made more difficult the satisfactory prepn. of the charge and the collection of the fume. C. L. READ

Western lead refined at East Chicago by Parkes Process. G. E. JOHNSON. *Eng. Mining J.* 128, 316-7(1929); cf. Hulst, *C. A.* 8, 3283. —Bullion from Tooele and East Helena and some scrap metal are refined by the Parkes process. Refined Pb, anti-monial Pb and doré are produced. C. L. READ

Fuming off zinc from lead slags at East Helena. ALEXANDER LAIST. *Eng. Mining J.* 128, 325(1929).—Molten slag from Pb blast furnaces, contg. 12-15% Zn, is charged into a furnace resembling a non-tipping converter. Air and pulverized coal are blown through the slag for 100-160 min. through 22 tuyères. The Zn and any Pb present in the slag are volatilized and burned to the oxides. The fume is cooled and collected in a series of flues and a bag house. From 20 to 35% coal is used and the Zn extn. runs from 85 to 90%. It is not economical to obtain higher recovery. C. L. READ

The copper deposits of Northern Rhodesia. ANTON GRAY AND R. J. PARKER. *Eng. Mining J.* 128, 384-9, 429-34, 470-3(1929).—The geology, ore bodies and potentialities of the district are reviewed with special reference to the N'Kana concession. W. H. BOYNTON

Development of copper smelting at Anaconda. LOUIS V. BENDER. *Eng. Mining J.* 128, 301-5 (1929).—The history of the development of the smelting plants at Anaconda, Great Falls, Tooele and Miami is given. The equipment now being used and the flow sheets for these plants are described. C. L. READ

Copper. HOMAR L. JOHNSON. *Mineral Ind.* 37, 123-72 (1928).—A review of the industry, including mining and production, prices, costs, trade and consumption. A. BUTTS

The metallurgy of copper in 1928. LEONARD S. AUSTIN. *Mineral Ind.* 37, 180-226 (1928).—A review describing new plants and technical developments. A. BUTTS

Poling of copper. P. SIEBE. *Metal Ind.* (London) 35, 3-7 (1929); cf. following abstr.—The phys. changes that occur during poling are given in detail under the following headings: fracture of button samples and microstructure of slabs, surface of slabs, d. and gas absorption, elec. cond. J. W. BOECK

Variation in density and electrical conductivity of copper during poling. P. SIEBE. *Metal u. Erz* 26, 397-400 (1929); cf. preceding abstr.—In the poling process, as O_2 content decreases from 0.3-0.4% to about 0.01%, d. falls from about 8.7 to about 8.2. Elec. cond. falls with overpoling, but little change occurs during the normal process. H. STOERTZ

Utilization of copper and copper alloys. WM. G. SCHNEIDER. *Mineral Ind.* 37, 172-9 (1928).—Distribution and use of Cu and brass are discussed. A. BUTTS

A new path in the metallurgy of nickel-copper separation. FR. VOGEL. *Metallbörse* 19, 1601-2 (1929).—The older sepn. of Cu-Ni by smelting them to high-grade mats, either with or without the use of alk. sulfides, and then leaching with H_2SO_4 , are compared with the Mond process (sepn. as $Ni(CO)_4$ from reduced Ni and Cu) and a new process (Canadian patent 279,756), with commendation for the last named. It involves concn. to a mat contg. 2.5% Fe, granulating in H_2O , grinding to 80 mesh, soln. of 99.0-99.9% Ni and Fe in hot 30% H_2SO_4 , removal of Fe by use of $Ni(OH)_2$, recovery of $NiSO_4$, decompn. into NiO by heat, smelting to Ni in a reverberatory furnace using petroleum retort coke as a reducing agent. The complete sepn. of noble metals from Ni is a valuable factor. W. C. EBAUGH

Production of platinum concentrates from Transvaal ores. T. K. PRENTICE. *J. Chem. Met. Mining Soc. S. Africa* 29, 269-83 (1929).—A general summary is given in detail of the semi working scale exptl. gravity and flotation concn. tests conducted by the Central Mining Rand Mines. According to the nature of the ore, the most successful methods were water, gravity, concn. by means of reciprocating tables in conjunction with corduroy or flotation or a combination of both. J. W. BOECK

Platinum group metals. GEORGE F. KUNZ. *Mineral Ind.* 37, 487-501 (1928).—Production, consumption, stocks, uses and technology are reviewed. A. BUTTS

Loss of metal by ball mill crushing in Swedish iron ore concentration works. ERNST ROTHÉLIUS. *Jernkontorets Ann.* 83, 267-88 (1928). ARNE DROGSETH

The iron ore problem in the future. HERMAN SUNDHOLM. *Jernkontorets Ann.* 83, 459-81 (1928).—S. assumes there will be no increase in production of Fe ore. A. D.

The circulation of iron. A study on the influence of scrap iron on the requirement of iron ore in the future and on the technical and economical conditions for production of iron. GÉRARD DE GEER. *Jernkontorets Ann.* 83, 7-43 (1928). ARNE DROGSETH

A modern scrap-iron precipitation plant. GAIL MARTIN. *Eng. Mining J.* 128, 467-8 (1929).—The Utah Copper Co.'s new equipment is briefly described. Detinned scrap is the pptg. agent and recoveries have jumped to 95% with a grade of ppt. of 90% Cu. Attendant costs have been reduced to a min. Several sections are illustrated. A notable and successful feature of practice at the Copperton pptn. plant is the ease with which boxes can be flushed of ppt. without moving the wooden grill and with an absence of all hand work except manning the hoses, gates and valves. W. H. BOYNTON

Some important factors in sponge iron production. EDWARD P. BARRETT. *Bur. Mines, Repts. of Investigations No. 2955*, 4 pp.; *Iron Steel Can.* 12, 240-1 (1929).—B. discusses the rate of reduction of Fe oxides and the factors affecting it, the penetration of heat through crushed Fe ore and carbonaceous material and the absorption of S by sponge Fe. ALDEN H. EMERY

Oxides in pig iron: their origin and action in the steel-making process. C. H. HERTY, JR., AND J. M. GAINES, JR. *Bur. Mines, Bull.* 308, 56 pp (1929); cf. C. A. 23, 2133-4. —Fe contains its max. oxide content when a furnace is operating irregularly as shown by the variation in Si content of the Fe or in tuyère temp. The elimination of oxides in the open hearth depends upon the size and nature (compa.) of the particles, the amts. of dissolved FeO and MnO in the steel, steel temp., slag viscosity and time for absorption of inclusions by the slag. Addns. of ore, cinder or pig Fe generally cause

an increase in the silicate content of the bath unless (for the first 2) the slag will support the lumps until dissolved. The silicate content of open-hearth steel before deoxidation depends on the silicate content of the charge and chiefly on SiO_2 in the pig Fe. Inclusions of this type are most harmful in rolling or forging. The chipping rejections on Bessemer screw stock varied with the SiO_2 content of the pig charged. A. H. E.

Iron and steel. SIDNEY G. KOON. *Mineral Ind.* 37, 298-348(1928).—Statistics of iron and steel, etc. are given. A. BUTTS

Metallurgy of iron and steel. H. M. BOYLSTON. *Mineral Ind.* 37, 349-59(1928).—A review, with bibliography. A. BUTTS

New developments in the working up of gold ores, particularly through the introduction of flotation methods. QUITTKAT. *Metall u. Erz* 26, 400-3(1929).—The bulk of Au and Ag ores is still treated by the cyanide process augmented by amalgamation. The flotation process has been limited to small installations. A combination of flotation with amalgamation and cyanide extn. gives the best results, harmful constituents being removed and a high yield of the metal obtained. H. STOERTZ

Gold and silver. H. N. LAWRIE. *Mineral Ind.* 37, 238-82(1928).—A review giving statistics of production and discussion of new developments in milling and metallurgy. A. BUTTS

Antimony. K. C. LI. *Mineral Ind.* 37, 28-33(1928).—World production, consumption and market are discussed. A. BUTTS

Bismuth. CLARENCE P. LINVILLE. *Mineral Ind.* 37, 63-4(1928).—A review of the Bi market and production. A. BUTTS

Cadmium. CLARENCE P. LINVILLE. *Mineral Ind.* 37, 71-3(1928).—An outline of production and uses is given. A. BUTTS

Chromium. WM. D. JOHNSTON, JR. *Mineral Ind.* 37, 74-83(1928).—A review of the industry, including chromite production, alloys and Cr plating, with bibliography. A. BUTTS

Cobalt. C. W. DRURY. *Mineral Ind.* 37, 118-20(1928).—A statistical review including production, trade, metallurgy and uses, with a bibliography. A. BUTTS

Manganese. CHAS. H. BEHRE, JR. *Mineral Ind.* 37, 400-13(1928).—A statistical discussion of the industry, including Mn alloys. World production, trade, market and technology are treated with a bibliography. A. BUTTS

Molybdenum. ALAN KISSOCK. *Mineral Ind.* 37, 426-9(1928).—Production, market and uses are discussed. A. BUTTS

Nickel. THOS. W. GIBSON. *Mineral Ind.* 37, 432-41(1928).—Sources, production and metallurgy are reviewed. A. BUTTS

Quicksilver. H. W. GOULD. *Mineral Ind.* 37, 538-44(1928).—A discussion of the industry, including world outputs, market and metallurgy. A. BUTTS

Radium, uranium and vanadium. FRANK L. HESS. *Mineral Ind.* 37, 545-50(1928).—World production and sources are treated and a bibliography is given. A. BUTTS

Tin. E. BALIOL SCOTT. *Mineral Ind.* 37, 582-98(1928).—A review, covering market, production, consumption and metallurgy. A. BUTTS

Consumption of tin in the United States during 1928. J. B. UMHAY. *Bur. Mines, Circ.* 6165, 8 pp.(1929). ALDEN H. EMERY

Tungsten. COLIN G. FINK. *Mineral Ind.* 37, 607-21(1928).—World production, trade and metallurgy of W are reviewed, with statistics and a bibliography. A. BUTTS

Zinc. JESSE A. ZOOK. *Mineral Ind.* 37, 622-50(1928).—Market, trade, smelting capacity and world production are reviewed with statistics. A. BUTTS

Metallurgy of zinc in 1928. W. R. INGALLS. *Mineral Ind.* 37, 650-8(1928).—Progress in smelting, roasting and sintering, distn. and hydrometallurgy is reviewed and the Waelz and other new processes are discussed. A. BUTTS

Application of pulverized coal to metallurgical furnaces. W. O. RENKIN. *Iron Steel Eng.* 6, 465-74(1929).—See C. A. 23, 4173. E. C. M.

Evolution of the slag tap furnace at Charles R. Huntley station of Buffalo General Electric Company. H. M. CUSHING. *Fuel in Science & Practice* 8, 311-21(1929).—See C. A. 23, 4106. D. A. REYNOLD

Repairing blast-furnace shafts without completely shutting them down. A. COUSIN. *Rev. métal.* 26, 395-400(1929).—In use, the top and especially the middle portion of blast-furnace shafts gradually wears down, in proportion with the rate of output of the furnace, while in the bottom of the shaft a protective coating of CaO forms, which is infusible at the working temp. of the furnace. If the furnace is completely shut down

for repairs, this protective coating slakes and crumbles in contact with moist cold air, so that it is necessary to rebuild the bottom portion of the furnace as well as the shaft, which generally requires several months. After the shaft wall has worn down considerably, the charge serves as a support for the wall, and if the charge is lowered below the level of the worn portion, there is danger of the wall collapsing. In order to prevent this, the Cockerill Co. has devised a system of external reinforcement for supporting the shaft and at the same time permitting ready accessibility for repairs. To effect repairs, the charge is allowed to fall to a level about 2 m. below that place where repairs are to be made. The company in this way reconstructed the entire shaft of a 250-ton furnace in 8 days (with complete shut down, the work would have required several months), and the repaired furnace has been in satisfactory operation since March 2, 1926.

A. PAPINEAU-COUTURE

Dependence of the operation of the Thomas converter on the temperature curve. RUDOLF FRERICH. *Stahl u. Eisen* 48, 1233-40(1928).—A Holborn Kurlbaum ardometer is described in detail, which registers the temp. during the blow of cast Fe in the converter. The type of the temp. curve depends on the type of pig Fe used and on the pressure during the blow. With an even high pressure during the entire operation a slag with low FeO content can be obtained.

J. A. SZILARD

Possibilities for improvement of heat economy of the Martin furnace. MAGNUS TIGERSCHJÖLD. *Jernkontorets Ann.* 83, 71-115(1928).

ARNE DROGSETH

Importance of the Brackelsberg furnace for the iron foundry. P. BARDENHEUER. *Foundry Trade J.* 41, 191-3, 210-11(1929).—See C. A. 23, 1852.

E. C. M.

A cylindrical tilting reverberatory furnace for smelting aluminum alloys. R. J. ANDERSON. *Metallwirtschaft* 8, 747-8(1929).—A cylinder made in 2 sections, easily taken apart and reassembled, is mounted on trunnions and provided with hand- or motor-driven tilting gears on one end. Oil-firing is employed, and high efficiencies are claimed.

W. C. EBAUGH

Mining methods and costs in the Waco district. LEON M. BANKS. *Can. Mining J.* 50, 583-8(1929).—History, ore deposits, exploration, development, ore mining and costs, mining cost per ton of ore delivered to mill bin, and a cost summary in units of labor, power and supplies.

W. H. ROYNTON

Newer conceptions of crystal growth [in metals]. W. KOSSEL. *Metallwirtschaft* 8, 877-81(1929).

E. J. C.

A metallographic study of some metallic arc welds. H. M. BOYLSTON, A. JENKIN AND J. C. CARPENTER. *J. Am. Welding Soc.* 8, No. 9, 26-47(1929).—The expts. described deal with the variables which affect the structure of the weld. Metallographic examn., phys. tests, and bend tests were made from which the allowable working stress has been calcd. by the Kinzel formula. Bibliography.

E. I. S.

Automatic thin-sheet arc welding. W. L. WARNER. *Iron Age* 124, 834-7(1929).

E. J. C.

Strength of butt welds made with metallic arc. G. TORO, JR. *Elec. World* 94, 387(1929).—Data are plotted for metallic arc-welded butt joints showing: that 45° is the best angle of bevel for a joint, strength decreasing with angle, single V joint is stronger than double V, strength of joint increases up to at least 1 in. thickness of plate.

M. McMAHON

How is lead being welded? R. W. MÜLLER. *Apparatebau* 41, 127(1929).—A discussion of the technique to be observed in lead burning.

M. C. ROGERS

The plastic deformation of metals. FREDERIECH KÖRBER. *Stahl u. Eisen* 48, 1433-41(1929); cf. C. A. 22, 3558.—A review of the present status of the study of the deformation of metals during cold and hot working, with numerous references and photomicrographs.

J. A. SZILARD

X-ray metallography in 1929. GEORGE L. CLARK. *Metals and Alloys* 1, 98-111(1929); cf. C. A. 23, 4915.—A detailed tabulation gives the x ray results (solid soln., lattice type, dimension, no. of atoms) on binary alloys. The source of the data for each alloy is given by means of a bibliography.

A. J. MONACK

The hardness and abrasion testing of metals. G. A. HANKINS. *Engineer* 148, 34-5, 61-3, 90-2(1929).—A synopsis prepd. for the Hardness Tests Research Comm. of the Inst. Mech. Engineers covering all work done since the publication of the Comm. Rept. of 1916 (cf. *Proc. Inst. Mech. Engineers* 2, 677(1916)).

D. B. DILL

The notched-bar impact test. R. H. GREAVES. *Metallurgist* (Suppl. to *Engineer* 147, June) 94-6(1929).—Results of 2500 impact and tensile tests on the same material, given in summary, indicate that "while steel with a poor elongation rarely gives a very high impact figure it is not so uncommon to find material with a good elongation giving

a low impact figure. The same applies when steels are grouped according to their reduction in area." D. B. DILL

Repeated-blow impact tests. R. H. GREAVES. *Metallurgist* (Suppl. to *Engineer* 147, May, June) 67 8, 88-90 (1929).—Recent literature is reviewed. "Assuming that tensile and single-blow notched-bar tests have been made on a material it is doubtful whether the results of repeated-blow tests add any information of value. The test, however, as it is carried out, is too complex to have any simple quant. significance." D. B. DILL

Special properties of eutectics and eutectoid alloys in binary metallic systems. P. YA. SALDAU. *J. Russ Phys.-Chem. Soc.* 61, 837-82 (1929); cf. C. A. 23, 3425.—Additional tables are given. E. C. M.

Eutectic composition of copper and tin. G. O. HIEBS AND G. P. DE FOREST. *Am. Inst. Mining Met. Eng., Tech. Pub. No.* 241, 13 pp (1929).—By means of soln. expts., cooling curves and microscopic exams., the eutectic compn. of Cu-Sn was found to be 0.94% Cu. The methods and app. are described in detail. J. W. BOECK

Examination of the system: aluminum-copper-zinc. HIDEO NISHIMURA. *Mem. College Eng. Kyoto Imp. Mines* 5, 61-132; *Chem. Zentr.* 1928, 11, 974.—The conditions for the equil. of the system Al-Zn were established first. N. not only uses the thermal analysis for the investigation of the solidification phenomena, but also for the detn. of the solid transformations. The existence of the following eutectic-peritectic transformations, which had been detected by other authors, was confirmed: liquid + α \rightleftharpoons β + CuAl, liquid + CuAl \rightleftharpoons β + ϵ ; liquid + ϵ \rightleftharpoons β + γ and liquid + ρ \rightleftharpoons CuAl + ϵ . Only the reaction liquid + CuAl \rightleftharpoons CuAl + β could not be observed. A new reaction liquid + CuAl \rightleftharpoons α + CuAl was detected. The β -soln. is converted into the ternary system by 2 stages: β + ϵ \rightleftharpoons CuAl + γ and β + CuAl \rightleftharpoons α + γ . In these equations α stands for the Al-rich and γ for the Zn-rich solid soln., while β corresponds to the solid soln. Al-Zn and ϵ to CuZn. The alloys were quenched, tempered at various temps. and their crystallographic structure and their hardness were examd. G. S.

The equilibrium diagram of the iron-molybdenum system. TAKESHI TAKEI AND TAKEJIRO MURAKAMI. *Science Repts. Tôhoku Imp. Univ.*, 1st Ser. 18, 135-53 (1929).—Alloys were prepd. from electrolytic Fe and Mo powder contg. about 0.1% C if Mo was below 50% and the others from reduced Fe and Mo powder. With Mo over 90% the melts were incomplete. Examn. was mainly microscopic but elec. resistance and dilatometric and magnetic analyses were also used. The compd. FeMo₂ is formed by peritectic reaction between 1450° and 1500° and similarly FeMo at 1540°. The latter exists at 56-63% of Mo and decomps. at about 1180° by a eutectoid reaction. Mo forms a solid soln. dissolving about 5% of Fe at room temp., soly. increasing with increase of temp. The A₂ point of the α solid soln. is lowered slightly as the Mo content increases while the A₃ point rapidly rises to 3% of Mo. In alloys contg. more than 63% Mo, a eutectoid is found consisting of FeMo and Mo dissolving Fe. Both FeMo₂ and FeMo are non-magnetic. Twenty-four photomicrographs are given. F. D. S.

Light weight [in railway equipment] can be obtained with aluminum alloys. A. H. WOOLLEN. *Elec. J.* 26, 468-70 (1929). A tabulation of the phys. and mech. properties of the light Al alloys commercially produced is included. C. G. F.

Etching of metallographic specimens. G. L. MOHR. *Apparatebau* 41, 135 (1929).—The technic of etching and factors to be considered. M. C. ROGERS

A synopsis of the present state of knowledge of the hardness and abrasion testing of metals with special reference to the work done during the period 1917-27, and a bibliography. G. A. HANKINS. *Proc. Inst. Mech. Eng.* 1929, No. 2, 317-73. E. J. C.

Use of the Martens mirror extensometer for hot-tensile-strength tests. LÉON GUILLET, JEAN GALIBOURG AND MICHEL O. SAMSON. *Rev. métal.* 26, 427-34 (1929). Results are given and discussed of hot-tensile-strength tests of steels. Cr-Mo steels exhibited a tensile strength approx. 5 times that of ordinary mild steel. A. P. C.

Material for the bottom of pistons of large Diesel engines. PAUL WOLFF. *Die Giesserei* 16, 121-5 (1929).—The expts. included chem. analyses, cold-tensile tests, tensile tests at different temps. and various preliminary treatments, bend tests, Brinell tests, repeated-impact tests, notch-impact tests, studies on the growth of the material, and metallographic investigations of material used for the bottom of pistons of large Diesel engines. The chem. compn. of the cast iron was as follows: 2.98-3.22% total C, 2.30% graphitic C, 0.76-0.93% Si, 0.56-0.71% Mn, 0.18-0.21% P and 0.104-0.130% S. C. H. LORIC

The specific volume of white cast iron. LEO ZIMMERMANN AND HANS KESER. *Arch. Eisenhüttenw.* 2, 867-70 (1929).—Data are given on the sp. vol. of white cast Fe from 0° to 1300°. App. and procedure are given. A. WHITE

High-test gray cast iron. European developments. EDWARD E. MARBAKER. *Foundry Trade J.* 41, 164-6 (1929) — See C. A. 23, 2405. E. C. M.

High-duty cast iron. J. E. HURST. *Iron & Steel Ind. and Brit. Foundryman* 2, 385-7 (1929). H. C. PARISH

Manganese in cast iron. A. L. NORBURY. *Foundry Trade J.* 41, 79-83 (1929).—In cast-Fe bars contg. 0 to 0.5% Mn, resp., the combined C fell as the Mn increased to about 0.3%. P, Ni and Al did not have a similar action in cast Fe. With very low Mn, FeS was present, and this restrained the decompn. of cementite. High S without correspondingly high Mn increased the combined C. To prevent this effect of S, Mn must be present to the extent of about 0.3% above the theoretical amt required to form MnS with the S present. Higher Mn contents have a stabilizing effect on pearlite and cementite, increasing the tendency to chill and combine C. The paper is illustrated by photomicrographs, and the previous literature is thoroughly discussed. Applications of the conclusions to foundry practice are considered briefly. GEO. F. COMSTOCK

Some notes on the distribution of sulfur and manganese in cast iron. R. T. ROLFE. *Iron & Steel Ind. and Brit. Foundryman* 2, 377-80 (1929).—Analysis of several portions of a flywheel rim showed that the Mn was practically const., whereas the S concd. in the upper part of the casting. H. C. PARISH

The formation of graphite, especially the eutectic, in cast iron. W. HEIKE AND G. MAY. *Die Giesserei* 16, 625-33, 645-9 (1929).—The influence of the cooling time, and of Mn, Si and C in cast Fe on the graphite formation is investigated. Mn acts slightly to suppress graphite formation, while with decrease in Si, C and cooling time the production of eutectic graphite is favored and the tendency to gray solidification of the Fe decreased. Eutectic graphite is formed at all C contents of the cast Fe, but the remaining factors should be so chosen that the tendency to gray solidification is reduced strongly. Eutectic graphite from cementite and from ferrite appearing in the graphite-ferrite eutectic are secondary products. It forms, however, only in cast Fe which has a small tendency to graphite formation. The ground-mass beside graphite consists of ferrite when the specimen is most rapidly cooled, of pearlite when less rapidly, and of ferrite when still less rapidly cooled. J. BALOZIAN

Eutectic cast iron. BERNHARD OSANN. *Die Giesserei* 16, 565-7 (1929).—The question of the formation of eutectic cast iron is considered from a theoretical standpoint. Fletcher's formula for C content of eutectic cast iron, $C = 4.3 - 0.286 Si - 0.387 P + 0.018 (Mn - 1.8 S)$ gives values that are high. At no time will this calculated value be below 3.43% C. In cast iron there are 6 components which det. the eutectic compn. of the iron. Analysis made of the liquid removed from partially solidified cast iron gave the compn. of the eutectic alloy as C 3.00%, Si 0.80%, Mn 0.30%, P 0.26% and S 0.07%. C. H. LORIG

The elasticity and repeated bending strength of cast iron. A. THUM AND H. UDE. *Die Giesserei* 16, 501-13, 547-56 (1929).—The elasticity of cast Fe is influenced by the no. and form of the graphite plates. Since the moduli of elasticity for compression and for tension are not equiv., and Hooke's law is not obeyed, calcs. of stress distribution in cast Fe subject to bending stresses using the stress formula $\sigma = M_y / I_y$ are in error. From repeated bending tests and from the measurement of tensile stresses in static bend specimens, the order of magnitude of the deviation of the actual from the theoretical bending stress was obtained, and its dependence on the material, cross section and bending moment within the elastic limit was studied. From the deflection and measured decrease in strength during the fatigue test process it was concluded that failure of cast Fe through fatigue is locally accelerated by graphite particles. The notch sensitivity of cast Fe is less than that for steel. High-test cast Fe is more sensitive to notch impact tests than graphite rich Fe. C. H. LORIG

The critical examination of steel castings. G. F. GILLOTT. *Foundry Trade J.* 41, 38-40, 50-60 (1929).—The methods of examg. steel castings are discussed with respect to x-ray, macroscopic and microscopic exams. C. L. READ

The practical application of nickel in cast iron. ARTHUR B. EVEREST. *Foundry Trade J.* 41, 61-4, 67 (1929); cf. C. A. 23, 2136. The addn. of approx. 1% Ni to the cast Fe gives castings of more uniform hardness, extraordinary closeness, and freedom from porosity in heavy sections and at junctions. Cast Fe contg. 2.3% Ni shows great uniformity of structure, high hardness figures, and it can be satisfactorily machined. Specific types of castings are cited where the casting was improved by the addn. of Ni to the cast Fe. C. L. READ

A contribution to the question of red-shortness. ALFRED NIEDENTHAL. *Arch. Eisenhüttenw.* 3, 79-97 (1929).—The degree of red- (hot) shortness is detd. by impact-bend tests at 700-1350° on notched and unnotched forged S-rich, C-rich and S- and O-

rich steels. The degree of brittleness is taken as the difference between the work of rupture and that required in changing the shape up to the point of rupture. The temp. at which red-shortness first appears is also a measure of the degree of brittleness. The red-shortness produced by S can be removed by a single heat treatment, while that by O cannot. With const. O content, the degree of red-shortness decreases with increasing Mn. O and S (Mn const.) produce together considerable brittleness, while separately (even at greater concns) none or little is caused. The shortness appearing at 700° (called red-shortness in the literature) is blue-shortness. The cause of the red-shortness produced by S and O is to be found in the difference in structures between the cast and forged conditions. The tensile properties of red-short steels are detd. at room temps.

J. BALOZIAN

The change of austenite into martensite. DARTREY LEWIS. *Heat Treating and Forging* 15, 991-4, 998(1929); cf. C. A. 23, 3197.—By dilatometric and magnetic curves is studied the change of austenite (A) into martensite (M) in 0.80% C steel wires heated to 1500°F. and quenched in molten salt baths (a nitrate-nitrite drawing salt) (1) at 800-300°F. (at 50° intervals) for 1/2 and 5 min., and (2) at 450°F. in molten salt for 1/2 min. then oil at 250°F., 150°F. and 100°F. for 5 min., and then cooled in air. On quenching at 450°F. the steel consists principally of A (stable for 5 min.) which changes into M on cooling in air. At 400°F. and 350°F. the change of A into M takes place in about 1/2 min., but at 300°F. the velocity of reaction is slower. On quenching at temps. up to 600°F. the stability of A decreases with increase in temp., little remaining after 5 min. at 600°F. Quenching according to 2 shows that at 200°F. the change to M is incomplete, while at 150°F. and 100°F. there is little evidence of it, probably because of the under-cooling effect prohibiting the recommencement of the change. The decompn. of A below 450°F. results in a Brinell hardness of 650, and the hardness from air-cooling is as great as from oil-cooling for the M transformation.

J. BALOZIAN

Recrystallization in cold-drawn tubes. RAGNAR P. ÅHRELL. *Jernkontorets Ann.* 83, 288-313(1928).—The controlling factors for the recrystn of 0.11% C cold-drawn steel tubes are reduction and temp. of annealing. Time is of secondary influence. The smaller the reduction the less the temp. interval in which recrystn occurs. The higher the reduction the lower the temp. of initial recrystn. The temp.-producing max. grain size decreases with decreasing reduction. The point of intersection of the curves for beginning of recrystn. and max. grain size indicates that with less reduction no recrystn. is possible. If the reduction is > 70% the material can never regain normal grain size unless remelted. Decarburization promotes increase of grain size. A. D.

Anomalies in the structure of steel. E. PIWOWARSKY. *Stahl u. Eisen* 48, 1665-9(1928).—Cases were observed, where after deoxidation with Al and V the steel exhibited a needle-like ferrite structure and also large grains of pearlite. No satisfactory explanation could be found for this behavior, though it seems that an improper treatment of the melt during the last stage and an improper deoxidation may be among the causes.

J. A. SZILARD

The structure of hardened carbon steels. B. D. ENLUND. *Jernkontorets Ann.* 83, 374-93(1928).—A survey and discussion of the different theories. E. has concd. his work on the distribution of C in hypoeutectoid steels.

ARNE DROGSETH

Martin elastic-limit steel. P. G. ROUSE. *Engineer* 148, 71(1929).—*Martinel* steel is being used for part of the topsides and deck structure of the liner "Empress of Britain." Its elastic limit is 15 tons per sq. in. min. and 16.7 av. Steel of high elastic limit is being considered by bridge designers for large-span steel bridges. D. B. DILL

Study on gases in liquid steel. EINAR AMÉN AND HARRY WILLNERS. *Jernkontorets Ann.* 83, 195-265(1928).—The method used is described. The tests were cooled very quickly by casting in a chill of 5-mm. steel plates, placed in a thicker cast-iron chill. The gases evolved by steel under vacuum were: CO, CO₂, H₂, N₂, CH₄, and H₂O. These gases are, for the most part, dissolved in the liquid steel but when the steel hardens or is placed under vacuum, the expelled gases can react together. The relation CO₂:CO at a given temp. is a measure of the degree of oxidation of the steel. The CH₄ and H₂O contents are a measure of the dissolved quantities of CO, CO₂ and H₂. N is found chiefly in steels from the converter. An expt. to remove the gases by hardening in elec. induction furnace gave good results. By subsequent addn. of a large quantity of scrap iron, the resulting steel showed the usual gas content. Figures of the app. diagrams, calcs. and a bibliography are given.

ARNE DROGSETH

Composition of the steel for various parts of textile machines. G. L. SAKHAROV. *Trans. Inst. Econ. Mineral. Met.* 1926, No. 27, 5-53.—For the spindles should be used open-heart steel, either acid or basic, of the following resp. compns: C 1.15-1.26, 0.95-1.05; Si below 0.2, below 0.25; Mn 0.3-0.4, 0.55-0.65; P below 0.03, below 0.03;

S below 0.03, below 0.03%. The spinning frame *rings* should be made of basic open-hearth steel contg. C 0.15–0.35, Si below 0.25, Mn 0.7–1.0, P below 0.05% and S below 0.05%. The *ring travelers* should be made of steel contg. C below 0.6%, Si below 0.15%, Mn 0.55–0.65%, S below 0.03%, P below 0.03%. If made of brass, the travelers should consist of about 30% Zn and 70% Cu. *Carding needles* should be composed of steel contg. C 0.35–0.55, Si up to 0.2, Mn up to 0.8, S below 0.03, P below 0.03%. The *printing rolls* should be made from a basic steel contg. C 0.10–0.27, Si below 0.05, Mn 0.6–0.8, S below 0.04, P below 0.04%; or from a steel that may be either acid or basic and contains C 0.44–0.50, Si below 0.25, Mn 0.35–0.50, S below 0.03, P below 0.03%. Analyses of various parts of numerous English textile machines, lengthy discussions of the desired properties of various metallic parts of the machines, detailed descriptions of the proper tempering and hardening and of their structure under the microscope are given.

BERNARD NELSON

Effect of alloying elements upon the stability of steel at elevated temperatures. A. E. WHITE AND C. L. CLARK. *Trans. Am. Soc. Mech. Eng.* 51, 213–34(1929).—Data are presented showing the effect of temps. to 1500°F. on the tensile properties of various types of alloy steels when in an annealed or normalized state and also the effect of heat treatments which would presumably bring out the best possible proportional limit values on various types of steels when tested at a temp. of 1000°F. A hypothesis is advanced to account for the influence of the different alloying elements on steels when at elevated temps. For temps below the equi-cohesive temp. the addn. or formation of any element, compd. or constituent, which does not enter into solid soln. with the matrix, but, which by the very nature of its presence interferes with the crystal slippage, or one which tends to increase the amt. of amorphous material, will increase the load-carrying ability of the material of which it forms a part. For temps. above the equi-cohesive temp. the addn. or formation of any element, compd. or constituent which tends to decrease the relative proportions of the amorphous material to cryst. material or which strengthens the grain boundaries by interfering with plastic flow will increase the load-carrying ability of the material of which it forms a part. A steel contg. 7.93% Cr and 7.70% W quenched at 2250°F. had the highest proportional limit which has yet been recorded at 1000°F.; namely, 100,000 lb./sq. in.

A. WHITE

Salt bath containers for hardening of high-speed tool steel. BENGT KJERRMAN. *Jernkontorets Ann.* 83, 595–600(1928).—Comparative tests were made in electrically heated furnaces with crucibles of different materials: chamotte (77.0% SiO₂, 20.0% Al₂O₃, 1.3% Fe₂O₃, 0.4% CaO, 0.3% MgO), silica (96.4% SiO₂, 1.0% Al₂O₃, 0.4% Fe₂O₃, 2.0% CaO), Alumo (14.5% SiO₂, 79.4% Al₂O₃, 2.2% Fe₂O₃, 3.9% CaO) and Carborundum (85% SiC), and BaCl₂ bath. Alumo was most durable, but too expensive. Chamotte was also durable, but gives high decarburization unless ferro-silicon is added and in the first expts. silica was found to be the only possible material.

A. D.

Microstructure of rapidly cooled steel. J. M. ROBERTSON. *Heat Treating and Forging* 15, 805–72(1929).—See C. A. 23, 3197.

J. BALOZIAN

Some x-ray studies of cold-worked steels. F. C. ELDER. *Heat Treating and Forging* 15, 717–20(1929).—See C. A. 23, 3886.

J. BALOZIAN

The effect of cold-working on boiler drums. FREDERICK G. STRAUB, H. S. NEWLIN, R. K. HOPKINS AND H. LEROY WHITNEY. *Power* 69, 998–1002(1929).—Caustic embrittlement due to high carbonate alk. occurs only where fabrication has set up internal strains. Various types of strains are illustrated with photomicrographs. Plates should be uniformly heated in a furnace to a temp. just above the upper crit. range of the steel to eliminate strains.

D. B. DILL

Recent developments in boiler-metal embrittlement. H. F. RECH. *Mech. Eng.* 51, 589–93(1929).—A discussion of boiler-metal embrittlement in which it is brought out that it is important to keep the SO₂-CO₂ ratio sufficiently high if failure of the tubes is to be prevented.

B. E. ROETHLI

Cause of brittleness in mild steel. G. R. BOLSOVER. *Heat Treating and Forging* 15, 714–6, 726(1929).—See C. A. 23, 3427.

J. BALOZIAN

Temper brittleness of some chromium-nickel steels and a nickel steel. BENGT PALMGREN. *Jernkontorets Ann.* 83, 20–50(1928).—After tempering to 450–650°, the max. resistance to shock is obtained by quickly cooling in water. ARNE DROGSETH

Examination of slag in tool steel by dark-field illumination. KURT AMBERG. *Jernkontorets Ann.* 83, 579–83(1928).—The method and app. are described and photomicrographs given.

ARNE DROGSETH

Oxidation of iron and steel by heat. L. B. PFELL. *Heat Treating and Forging* 15, 734–40, 852–9(1929).—See C. A. 23, 3196.

J. BALOZIAN

Manganese steel: study of its physical properties in relation to its microstructure

and heat treatment. V. N. SVETCHNIKOFF. *Rev. métal.* **26**, 401-8(1929).—Steel contg. C 1.23, Mn 12.67, Si 0.35, P 0.012%, in the form of forged test bars quenched from 850°, 950°, 1050°, 1150° and 1250°, was subjected to impact tests on the Charpy machine and to wear tests by means of Carborundum and H₂O. Max. resiliency and resistance to wear were found in the samples quenched from 1150°. On plotting the Shore hardness, Brinell hardness and density as functions of quenching temp., the direction of each curve changes at 1150°. At 950° quenching temp. the coarse carbide network structure disappears. Samples quenched from 1250° show signs of burning. The results of the heat treatments obtained in the present instance are believed due to the high P content. Its remarkable wear resistance is due to the fact that it combines with it a very high resiliency and also that it hardens very easily by cold working, the Shore hardness being increased about 120% in the wear test. As it loses its resiliency at a relatively low temp. (450°), annealing destroys one of its most valuable properties.

A. PAPINEAU-COUTURE

Hardness features in "Widia" and manganese steel. HUGH O'NEILL. *Metalurgist* (Suppl. to *Engineer* **148**, August) 115-7(1929).—Widia, consisting of W carbide with 6% Co, has an abrasive hardness of about 8. Its Brinell hardness no. of 1310 indicates it is 250 times as hard as Pb. It is not superior to water quenched Mn steel in its capacity for strain hardening.

D. B. DILL

Investigation on tungsten steel. WERNER ZIELER. *Arch. Eisenhüttenw.* **3**, 61-78 (1929).—The metallography and hardness of W steels (contg. 0.3, 0.7, 1.1 and 1.4% C, each having 0, 1, 5, 10, 15 and 20% W) are studied. The solv. lines of C in W steels, and the differences between the stable and metastable phases in the Fe-W-C condition diagram agree with those of other workers. The constituents of W steel are Fe-C, Fe₃W (present in Fe-W and Fe-W-C alloys with C less than 0.30%), the double carbides I and II (Hultgren's Z₁ and Z₂ carbides, resp.), and the stable carbide WC (present in Fe-W-C alloys high in C). A stable and a metastable double carbide appear in Fe-W-C alloys with medium and high C. In alloys contg. less than 0.30% C the A₁ point is raised with increase in W, but simultaneously the intensity decreases. A₁ is const. for medium and high C, lying between 730° and 790°, while A₂ is raised with increasing W, lying between 740° and 805°. A₁ and A₂ are lowered by the addn. of W. If sufficient C is present in solid soln. For the best alloys the C should increase 0.70% for each 1% W. A W steel with 20% W and 1.4% C has a Brinell hardness of 712, and a hardness range from 750° to 1100°. For the best cutting power the W in the steel should not exceed 25%, the C 1.6%, and the Cr should be 0.6-0.7%.

J. BALOZIAN

The influence of molybdenum and silicon on the properties of a non-corrodible steel. CARL F. WÜRTH. *Diss. Tech. Hochschule Aachen* 1927, 14 pp.; *Physik. Ber.* **9**, 147. Increasing quantities of Mo, Si and C have been added to a 15% Cr steel. The resulting properties have then been investigated. 0.3% Mo gives max. hardness. More than 0.3% C is not advisable because the hardness increases only very little, while the resistance to corrosion is badly affected. Neither the A₁ nor the A₂ transformation point can be detected in soft steels contg. more than 3% Si. All the steels with more than 3% Si are brittle. Mo-Cr steels are not corroded in AcOH or in sea-water. HgCl₂ is a good detector of pores and flaws. All steels with high Si content resist scaling at high temp. remarkably well. The same holds for Si-Mo steels. The resistance to scaling increases with the C content.

ALBERT L. HENNE

Alloy cast steels. DAVID ZUEGE. *Foundry Trade J.* **41**, 167-8(1929). See C. A. **23**, 2406.

E. C. M.

The x-ray investigation of alloys: a summary of published information, 1921-1928. C. F. ELAM. *J. Inst. Metals* **41**, 329-42(1929).

E. J. C.

Service characteristics of light alloys. E. H. DIX, JR. *Am. Mach.* **71**, 441-4 (1929).—Summary of improvements made in Al- and Mg base materials to increase strength and reduce corrosion.

E. I. S.

Hot testing of metals and alloys by compression and by drawing. ALBERT PORTEVIN. *Rev. métal.* **26**, 435-43(1929).—A discussion is given of the interpretation of the results of hot (to about 450-500°) compression tests of ultra-light metals (Mg and its alloys), showing how they may be used for detg. the suitability of the metals for drawing. A no. of such alloys were tested; a few of the diagrams are given, but no numerical values are tabulated. A study carried out in 1923-24 on the drawing of ultra-light alloys prep'd. by addn. of Al, Cr, Ce, Cu, Mn, Ni, Pb, Si, Zn, Al-Cu, Al-Ni, Al-Zn and Cu-Mn to Mg gave results in general agreement with the diagrams of the resp. alloys. More particularly, the appearance of a binary or ternary eutectic of low solidifying pt. requires a decrease in the drawing temp.; e. g., Mg-Al alloys are drawn under the same

conditions as pure Mg up to 7% Al, which is the limit for the solid soln.; on the other hand, Mg-Zn alloys can be drawn like pure Mg up to 5% Zn, while the diagrams which had been published at that time indicate the presence of a Mg-MgZn₂ eutectic melting at 347° without formation of a soln. with high Mg content (the diagram recently published by Schmidt and Hansen, cf. Meissner, *C. A.* 21, 3882, is in agreement with P.'s conclusions); alloys contg. more than 5% Zn could not be drawn at a temp. between 280° and 440°; it follows that with up to 5% Zn there must be a solid soln. Similarly, Mg-Al-Cu alloys can be drawn like pure Mg up to 8% Al, and also Mg-Al-Zn alloys in which $7Zn + 5Al < 35$, indicating the existence of solid solns. which, up to the present time, have not been mentioned on the ternary diagrams published. A. P.-C.

Suggested program for a general organization of investigations on the behavior of alloys at high temperatures. ANDRÉ MICHEL. *Rev. métal.* 26, 447-50 (1929).

A. PAPINEAU-COUTURE

Theories of age hardening of aluminum alloys. M. L. V. GAYLER AND G. D. PRESTON. *Can. Chem. Met.* 13, 251-2; *Engineering* 127, 342-5 (1929).—See *C. A.* 23, 2685.

W. H. BOYNTON

The intensity of magnetization in iron-nickel-cobalt alloys. HAKAR MASUMOTO. *Science Repts. Tohoku Imp. Univ.* 18, 195-229 (1929).—Chill-cast rods of binary and ternary alloys of Fe, Ni and Co were tested for uniformity and annealed, and the intensity of magnetization was measured by the ballistic method. The results for each series of alloys are tabulated, plotted and discussed. The magnetization curve of the reversible Fe-Ni alloys is similar in form to that of pure Fe or Ni, but the irreversible alloys were much less magnetizable. The magnetization-concn. curve has a min. at 30% Ni, and max. at 5 and 45% Ni. In the Fe-Co alloys, the α and γ solns. were easily magnetizable, but the hexagonal soln. contg. over 95% Co was not. The alloy contg. 92% Co had a very high permeability. The Ni-Co alloys contg. over 30% Ni had a face-centered cubic lattice and were easily magnetizable, but those contg. 70% or more Co were hexagonal and less magnetizable. The addn. of Co up to 50% reduced the permeability of the reversible Fe-Ni alloys. The irreversible Fe-Ni-Co alloys and the hexagonal alloys were not easily magnetized. The addn. of Co up to 80% gradually raised the low magnetization value of the 30% Ni-Fe alloy.

GEO. F. COMSTOCK

Contribution to the study of the action of gases upon metals. II. The statistics of the systems: chromium nitrogen and manganese-nitrogen. GABRIEL VALENSI. *J. chim. phys.* 26, 202-18 (1929), cf. *C. A.* 23, 3196.—The dissociation of CrN is analogous to that of palladium hydride. CrN may adsorb small quantities of N₂. CrN is also sol. in Cr especially at higher temps. Mn up to pressures of 1.5 atm. gives only solns. of the nitride with itself, but the curves for the system show a similarity to those of Cr, indicating that at higher pressures Mn₃N₂ may exist in a pure state. The soly. of the products of these reactions in the metals themselves seems to be a general phenomenon. This fact also seems to be an explanation for the term "dissolved gas" commonly encountered. A discussion of several supplementary facts such as methods and app. used, methods for the rapid exploration of zones of reaction between metal and gas, the functions of temp. and pressure, etc., is given in some detail.

L. L. O'QUILL

So-called "usual commercial" cast brass. WILLI CLAUS. *Die Giesserei* 16, 480-5 (1929).—The chem. compn. and physical properties of 23 so-called "usual commercial" brasses received from 15 manufacturers were detd. High Sn or Sn + Pb contents cause changes in the microstructure of the cast specimens. These impurities lower the tensile strength and greatly decrease the elongation of the brasses.

C. H. LORIG

Note on the crystal structure of the α copper-tin alloys. ROBERT F. MEHL AND CHARLES S. BARRETT. *Am. Inst. of Mining Met. Eng., Tech. Publication No.* 231, 6 pp. (1929).—The side of the unit face-centered cube and the d. were detd. for 3 compds. (4, 8 and 12% Sn) in the α field of the Cu-Sn system. It is shown, contrary to previously published work, that this solid soln. is simple substitutional in type.

J. W. BOECK

Information on cast tin-copper alloys. WILLI CLAUS AND HANNS GOEKE. *Die Giesserei* 16, 73-80, 98-105, 125-32, 153-60 (1929).—Alloys contg. 6, 10, 14 and 20% Sn were cast in dry sand, green sand and chilled molds placed in vertical and horizontal positions. In investigating the magnitude of "inverted" liquation in the ingots it was found that samples from the outer surface and bottom of the ingots contained the highest concn. of Sn. In dry and green sand vertically cast ingots the difference in Sn content from center to outside of ingot was as much as 1.2% Sn. Variations of 2% Sn were observed in chilled molds. By casting the ingots in the horizontal position the liquation was lessened. By decreasing the pouring temp. the liquation decreased. The "inverted" ingot liquation results from the action of SO₂ dissolved in the molten metal. On solidification the soly. of SO₂ in the metal decreases; thus the mother liquor becomes

supersatd. The liberated gas cannot diffuse through hot Cu and it therefore forces the Sn-rich liquid into the head of the casting and between the crystals of Cu formed on the outside of the ingot. As proof of their theory the authors cite the work of Kuhnel who prepd. ingots under similar melting and pouring conditions. Kuhnel found the magnitude of the "inverted" ingot liquation increased proportionally with the S content of the melt. The differences in phys. properties of bars cut from the center and outer portions of the ingots correspond to the differences in Sn content as detd. by analytical investigation. No exact relation between magnitude of liquation and Brinell hardness, could be found, nor was it possible to relate the hardness to tensile strength.

C. H. LORIG

Information on the properties of a cast tin bronze (bearing and screen bronze) with 12% tin. WILLI CLAUS. *Die Giesserei* 16, 401-3(1929).—Tensile and hardness tests were made on a series of cast tin-bronze alloys contg. 88.12-88.28% Cu, 11.73% Sn and 0.05-0.06% Ni. Ten test pieces of 15 mm. diam. were machined from round billets which were cast in green sand molds. The pouring temp. of the metal was 100° above the m. p. of the alloy. An ultimate strength of 11.6 to 17.6 kg./sq. mm., and an elongation of 1.0 to 4.1% were obtained.

C. H. LORIG

Bearing bronzes with and without zinc. H. J. FRENCH AND E. M. STAPLES. *Bur. Standards J. Research* 2, 1017-38; *Metal Ind.* (London) 35, 177-80(1929).—See C. A. 23, 3889.

E. C. M.

Phosphor bronzes. EDMUND R. THEWS. *Giesserei-Ztg.* 25, 213-20(1928); *Chem. Zentr.* 1928, I, 2657.—The prepn. and properties of Cu phosphides are described. An alloy of Cu with 10-15% of P is a valuable deoxidation agent. The disadvantages of P in alloys as well as the influence of varying % of P in bronzes are discussed.

C. R. FELLERS

The Brinell hardness of the ternary alloys of copper, zinc and aluminum as an α solution. HIROSHI KAWAI. *Mem. Coll. Science, Kyoto Imp. Univ.* 11, 137-47(1928).—The variation of hardness in the ternary alloys shows the same relation as with binary alloys. When the soly. limits are relatively large there exists a max. in the field of the solid soln. When the limits are relatively narrow the hardness curve will continue to rise till it reaches the boundary lines. Beyond this line the curve may rise gradually or rapidly.

O. A. NELSON

The theory of methods of industrial hygiene: Experiments on the forced respiration by animals of measured mixtures of lead oxide dispersions and air, with reference to the origin of lead poisoning among lead solderers. VICTOR FROBOESE AND HERMANN BRÜCKNER. *Arch. Hyg.* 101, 161-72(1929).—Pb poisoning is more apt to occur as the result of the inhalation of fine, dust-like particles of Pb or PbO than as the result of their ingestion. An app. is described for the prepn. and accurate measurement of gaseous mixts. of PbO and air.

F. R. MAIN

Effect of alloying on the permissible fiber stress in corrugated zinc roofing. E. A. ANDERSON. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 232*, 9 pp(1929).—The development and testing of a Zn alloy having a sufficiently high working stress to permit its use on purlin spacings usually used for steel sheets. An alloy of Zn plus 1.0% Cu and 0.1% Mg was selected for further study and a comparison with unalloyed Zn is given.

J. W. BOECK

Metallography of commercial thorium. EDMUND S. DAVENPORT. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 226*, 14 pp.(1929).—The properties of Th produced by the Ca-CaCl₂ reduction, modified to meet com. conditions, with particular reference to cold working, are described. Density, Rockwell hardness, tensile properties and microstructure are discussed. ThO₂ and an impurity referred to as "carbide" are illustrated.

J. W. BOECK

Bending of aluminum crystals. KENZO TANAKA. *Mem. Coll. Science, Kyoto Imp. Univ.* 11A, No 3, 199-203(1928).—The effect of bending Al plates composed of large single crystals was investigated by means of distortions of the Laue spots. The orientation of the microcrystals produced by the destruction of the single crystal at the time of bending was found to be scattered around the axis of bending including the initial orientation, so that the microcrystals revolve to some extent around this axis of bending. The same result was also obtained with Al wires, each composed of single crystals when they were subjected to slight bending.

O. A. NELSON

X-ray investigation of the mechanism of strengthening an aluminum alloy. VON GÖLER AND G. SACHS. *Naturwissenschaften* 17, 309-12(1929); cf. C. A. 23, 4680.—A preliminary note. X-ray research on the lattice const. of a quenched Al alloy (5% Cu) annealed at several temps. and for various times showed that at 150° to 200° where considerable change in strength has taken place no difference in lattice const. of

more than 0.01% is noticeable. Above 225° the interference spots in the diagram begin to spread indicating increasing lattice const. At 300° the limit is reached and a slight retraction occurs caused by dissolving of Cu. Annealing for 24 hrs. at 150° causes the solid soln. to decomp. to the extent of 10 to 20%. Decompn. is complete at 200° in 3 hrs. The strengthening which occurs before noticeable lattice changes is explained by precrystn. effects in the satd. soln. (Fraenkel, and Marx C. A. 23, 1857) like assocn. processes (CuAl₂ mols.) or colloidal aggregation.

B. J. C. VAN DER HOEVEN

Dilatometric investigation of the thermal effects on annealing duralumin and its structural components. M. HAAS AND H. HECKER. *Metals and Alloys* 1, 124-30 (1929).—See C. A. 23, 3651.

A. J. MONACK

Aluminum and its alloys in aircraft. T. W. BOSSERT. *Trans. Am. Electrochem. Soc.* 56 (preprint) 6 pp. (1929).—The evolutionary stages of aircraft construction are outlined. The widespread adoption of metal construction in aircraft has resulted from the availability of the strong Al alloys, with the strength of structural steel but only 1/3 its weight. The properties of these alloys are outlined and characteristic examples of their application are described and illustrated.

C. G. F.

Magnesium or aluminum? FRIEDRICH VOGEL. *Metallbörse*, 19, 929-30, 1436, 1884-5 (1929).—Because of its low sp. gr. and high m. p. Be may become a competitor of Mg especially in aircraft construction. "Elektronmetal" is a collective name for a series of Mg alloys contg. about 90% Mg with metals such as Zn and Al, and small quantities of Cu, Mn, Cd, etc. Less important are alloys of Mg and Fe. As impure Mg corrodes easily, the metal must be purified from other metals, Mg nitride and oxide, by treatment with H, halides of alkali and alkaline earth metals, etc. The addn of 0.05-1.0% Ca improves the quality of Mg greatly. Pouring molten Mg through fine-mesh steel sieves improves the castings. For pressed ware temps. of 250-350° and pressures of 250-300 atm. are needed, but quality is excellent, tensile strength, 25-35 kg./sq. mm., elongation, 11-22%, contraction of area, 8-16% and Brinell hardness, 50-60, depending upon the compn. of the alloy. Where great elasticity is needed Mg alloys are not advantageous. The low sp. gr. (about 1.82) and resistance to corrosion by benzine make it suitable for use in constructing tanks for air craft. Mg is easily machined and is not acted upon readily by alk. and Fe compds. Whereas Si and Fe were considered very injurious ingredients of Al alloys and ores at first, they are now employed more freely, Si forms excellent alloys with Al, but Fe requires removal from the bauxite before smelting. Tables giving compn. and properties of Mg and Al alloys are given. W. C. E.

The texture of drawn magnesium and zinc wire. E. SCHMID AND G. WASSERMANN. *Naturwissenschaften* 17, 312-4 (1929).—Spiral and ring-fiber texture has been detected in drawn Mg and Zn wires. Mg wire (drawn at 200°) has the hexagonal axis almost perpendicular to the wire axis. The angle is smaller in the outer zone of the wire (15°), i. e. the hexagonal axis is on a centered single cone of about 2 X 75° top angle (centered ring fiber structure). For Zn wire (drawn at room temp. or 100°) a spiral fiber texture is found with the hexagonal axis at an angle of about 72° (12° deviation) with the wire axis (double cone texture). For both metals the drawing process was unidirectional.

B. J. C. VAN DER HOEVEN

Magnesium and its alloys in aircraft. W. G. HARVEY. *Trans. Am. Electrochem. Soc.* 56 (preprint) 10 pp. (1929).—Mg is 1/3 lighter than Al, and is used in airplane construction. Because of its inherent chem. and mech. characteristics, it has been difficult to work the metal into useful shapes. However, recently, through the discovery of methods of purification of the metal and of the methods of heat-treatment of Mg alloys, most fabricating obstacles have been overcome. Today Mg-alloy castings are made possessing mech. properties substantially equal to the best of the high-strength Al alloys. The mech. properties of Mg alloys are tabulated. Through careful purification of the Mg metal and alloying this with certain metals, such as Mn, alloys have been developed which show remarkable resistance to corrosion. The making of Mg forgings has just emerged from the exptl. stage. The forgings possess comparatively high mech. strength. Forged Mg propeller blades can be produced with weights not differing materially from those obtained with wood.

C. G. F.

Galvanized pipes. (Metal coating.) M. GRELLERT. *Apparatebau* 41, 128 (1929).—Inside galvanizing cannot be used for pipes conducting water which contains CO₂ because of the action on Zn. Cu piping is recommended. Inside galvanizing is not necessary where very hard water is to be conducted, because the lime deposit inside the pipe will furnish sufficient protection against rust. Inside galvanizing gives very good protection where water of medium or low hardness is conducted, and prevents the yellowish, reddish and dark coloring of the water. Outside galvanizing gives very good

protection against rust formation for pipes conducting cold water where sweating of the pipes occurs. M. C. ROGERS

Galvanized pipes. (Metal coating.) M. GRELLERT. *Apparatebau* 41, 115 (1929).—A discussion of the relative merits of Zn as a protective coating on metals.

M. C. ROGERS
ANON. *Metallwaren-*

noval of the article from the bath, too low an temperature of the bath, etc. GUSTAF SODERBERG

The art of patinizing. HEINZ LANGE. *Metallwaren-Ind. Galvano-Tech.* 27, 189-90, 330-1 (1929).—A review of methods for the production of artificial patina on Sn and Sn-Zn bronzes. GUSTAF SODERBERG

Bulk polishing (of metals) by means of ball burnishing. RUDOLF PLUCKER. *Metallwaren-Ind. Galvano-Tech.* 27, 251-3 (1929).—A discussion of principles and practical methods. GUSTAF SODERBERG

Copper-lined steel boiler. KURT KAPLER. *Apparatebau* 41, 152 (1929).—The Cu lining prevents corrosion, and the steel shell takes care of the pressure requirements. M. C. ROGERS

Processes for applying lead coatings in molten baths. ANON. *Metallwaren-Ind. Galvano-Tech.* 27, 209-10 (1929).—A review of cleaning and Pb coating processes for Fe steel, Cu and Cu alloys is given, also a no. of Pb alloy compns. for the same purpose. GUSTAF SODERBERG

Zinc coating failures in galvanizing traceable to many causes. WALLACE G. IMHOFF. *Iron Trade Rev.* 85, 451-2, 455, 456 (1929).—The causes of Zn coating failures are discussed and tabulated. LESLIE B. BRAGG

Inhibitors in pickling process. ALLISON D. TURNBULL. *Iron Age* 124, 598-600 (1929).—Tests show that when the W. & M. gage of Fe rods is plotted against lb. H₂ evolved in 15 min. an almost straight line results, with a loss of 0.070 lb. H₂ per ton Fe for 7-0 and 0.105 for 5 W. & M. gage. Without inhibitor the concn. of H₂SO₄ dropped from 4.21 to 3% in 25 min. and with inhibitor from 4.21 to 3.4 in the same time. The evolution of H₂ gas on the surface embrittles the metal. HANS C. DUES

Distribution and velocity of the corrosion of metals. ULLICH R. EVANS. *J. Frank. lin Inst.* 208, No. 4, 45-58 (1929).—O₂ is needed for corrosion, but the attack occurs at places relatively inaccessible to O₂. The direct effect of O₂ is to maintain a protective film and the indirect effect to set up corrosion where the film is weak. The protective effect of various oxides depends upon the rate of oxidation of the metal, thickness of film and its mech. strength. Localized attack is due to differences in the state of repair of the protective film. This is affected by certain ions which have the power to penetrate the film at its weakest points. Where corrosion has spread out over a large anodic area the penetrating power of ions is unimportant. Film formers if not present in sufficient quantities tend to isolate the corrosion at points with the ultimate formation of deep pits. For success the metal must be chosen so that the primary reaction product is protective as secondary products do not in general prevent attack. The velocity of corrosion is a function of both the O₂ supply and the nature of the metal. B. E. R.

Corrosion, residual current and passivity. III. F. TÖDT. *Z. Elektrochem.* 34, 853-7 (1929); cf. *C. A.* 23, 1859.—It is shown that intensity of current which flows between 2 metals, e. g. Fe and Pt, when immersed in a soln., is a measure of the corrosion exhibited by the baser metal. It is claimed that the corrosive properties of solns. and the corrosion of metals can be directly detd. and that the course of changes in resistance to corrosion such as film formation can be followed so that it becomes possible to show how soon passivity sets in. B. C. A.

Quantitative measurements of corrosion of metals in water and potassium chloride solutions. G. D. BENGOUGH, J. M. STUART AND A. R. LEE. *Am. Inst. Mining. Met. Eng., Tech. Publication*, No. 177, 20 pp. (1929).—See *C. A.* 23, 1380. B. E. R.

The influence of oxygen on corrosion fatigue. A. M. BINNIE. *Engineering* 128, 190-1 (1929).—Wöhler alternating-stress tests were made of steels contg. 0.04% and 0.33% C, resp., with the application of salt water in air, and in an atm. of H₂. The normal fatigue limit of the 0.9% C steel was 17 tons per sq. in. With salt drip in air it was 7.5, and with salt drip in H₂ it was 9.1 tons per sq. in. The cracked area of the corrosion-fatigued specimens was blackened but not rusty. The fatigue limit of the 0.33% C steel was 18.3, and the corrosion fatigue limit with salt drip both in air and in

ordinary H was 9.2 tons per sq. in. When the H was specially purified it rose to 11.8, and the blackening of the surface was less. G. F. C.

Fatigue and corrosion—fatigue of spring material. D. J. McADAM, JR. *Trans. Am. Soc. Mech. Eng. Applied Mechanics* 51, 45-58 (1929).—Spring steels subjected to a range of stress in contact with fresh water fail at a stress range $\frac{1}{4}$ to $\frac{1}{5}$ the ordinary endurance limit. With salt water the endurance range is still smaller. The corrosion-fatigue limit depends more on electrochem. than on phys. properties. Corrosion-resistant steels have about twice the corrosion-fatigue limit of ordinary steels. Electroplating with Cd more than doubles this limit. The importance of protecting spring material against corrosion, when under alternating stress, cannot be overemphasized.

H. C. PARISH

Solution potentials of aluminum alloys in relation to corrosion. JUNIUS D. EDWARDS AND CYRIL S. TAYLOR. *Trans. Am. Electrochem. Soc.* 56, (preprint) 7 pp. (1929).—The potential differences arising from contacts between Al and Al alloys, as well as other metals, in the presence of an electrolyte, are of theoretical interest and practical importance. Although these potential measurements show such wide variations that their quantitative significance is limited, qualitatively they are important in explaining the behavior of the metals in contact under corrosive conditions. Pure Al is electronegative to many of its alloys, and particularly to duralumin (No. 178). This fact is of importance in connection with the protection of exposed edges on duplex metal products, such as "Alclad" sheet (the two outer layers Al, inner layer duralumin). C. G. F.

Pb (SANTMYERS) 18. Al and bauxite (MANTELL) 18. X ray investigation of the nitrides of Mn (HAGG) 2. Metallic diffusion (VAN ARKEL) 2. Heat conduction problems (GRIFFITHS) 2. Ag in chemistry and pharmacy (DYSON) 2. The ternary system: Pb-Zn-Bi (FINCKE) 2. A recording apparatus for determination of the magnetic transition points of small samples (LEHRER) 1. Technical physics in the Fe industry (KÖRDER) 13. The correlation of the physical and chemical properties of cokes with their value in metallurgical processes (BRAUNHOLTZ, *et al.*) 21. The deterioration of structures of timber, metal and concrete exposed to the action of sea water (PURSER, GROSE) 20. Determination of free lime in slags and cements (DIEPSCHLAG, MATTING) 20. States of mind which make and miss discoveries. With some ideas about metals (LODGE) 2. The affinity of Al for O (DE BIRAN) 6. Corrosion and how to prevent it (McAMIS) 14. Practical application of corrosion tests—resistance of Ni and Monel metal to corrosion by milk (McKAY, *et al.*) 12. Corrosive action of water on pipe lines (WINKELMANN) 14. Colorimeter [for testing steel] (U. S. pat. 1,728,358) 1.

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EDWARDS, C. A. **Some Technical Aspects of the Manufacture of Steel Sheets and Tin Plates.** Swansea, Eng. The Welsh Plate and Steel Mfrs. Assoc. 94 pp. Reviewed in *Metals & Alloys* 1, 133 (1929).

HENDRICKS, MEREDITH S. **The Oxy-Acetylene Welder's Handbook.** Chicago: The Acetylene Journal Pub. Co. 208 pp.

NEUBURGER, M. C. **Röntgenographie der Metalle und ihrer Legierungen.** Berlin: V. D. I. Buchhandlung. M. 21

TAFEL, VICTOR. **Lehrbuch der Metallhüttenkunde.** Bd. II. Wismut, Blei, Zinn, Antimon, Zink, Quecksilber, Nickel, Aluminum. Leipzig. S. Hirzel. 671 pp. M. 55.50; linen, M. 59

Briquets for metallurgical processes. LEO L. SIMPSON (to New Era Iron and Steel Corp.). U. S. 1,729,496, Sept. 24. Materials such as low grade Fe ores are formed into briquets with a binder comprising opal siliceous matter, lye and borax.

Roasting ores. NATIONAL PROCESSES, LTD., and S. ROBSON. Brit. 307,439, Nov. 8, 1927. A pyritic ore is mixed with a coarse granular or nodular material such as a crushed product from a previous blast roasting operation or crushed pumice or slag in proportions such as to ensure such porosity in the charge that air can be readily drawn through it; the charge is then subjected to blast roasting with exclusion of air other than that drawn through the charge itself; a gas is thus obtained sufficiently rich as to be suitable for use in H_2SO_4 manuf.

Open-pan roasting and sintering apparatus of the rotary type. NATIONAL PROCESSES, LTD., and G. E. STOKER. Brit. 306,674, Jan. 25, 1928. Structural features.

Open-pan roasting and sintering apparatus of the rotary type for treating ores.

NATIONAL PROCESSES, LTD., and G. E. STORER. Brit. 306,787, July 21, 1928. Structural features.

Ore flotation apparatus. COMPAGNIE NOUVELLE DES MINES DE VILLEMAGNE. Fr. 659,813, Aug. 31, 1928.

Apparatus for magnetic separation of ore constituents. HARRY P. OSBORNE, CLIFTON C. FARMER and REUBEN B. TEETER (one-half to A. A. Crane). U. S. 1,729,008, Sept. 24. Structural features.

Flotation separation of sulfide ores. SHERWIN P. LOWE. U. S. 1,728,352, Sept. 17. Ore contg. Cu, Zn and Fe sulfides is sepd. by flotation into a Cu concentrate, a Zn concentrate and a tailing carrying a large percentage of the Fe sulfides; during the Cu flotation the pulp is maintained at an alk. of 0.01-0.15 lb. CaO per ton of water, and during the Zn flotation at an alk. of 0.4-0.7 lb. per ton of water. U. S. 1,728,353 specifies concentrating ores by froth flotation with addn. of ZnO in addn. to other well known oils and other reagents to the pulp to obtain higher grade concentrates.

Froth-flotation concentration of ores. CORNELIUS H. KELLER (to Minerals Separation North American Corp.). U. S. 1,728,764, Sept. 17. A suitable pulp of an ore such as Utah Cu ore, lime and hardwood creosote is agitated with Na ethyl mercaptide, and the mineral-value-bearing froth is sepd. Cf. C. I. 23, 4433.

Reducing ores, etc. HENRY E. COLEY. Fr. 659,422, Aug. 23, 1928. An app. is described for reducing ores, oxides, etc., in which the sepn. of the vapors or metallic fumes and gases liberated is effected by means of a liquid such as water or paraffin.

Continuous reduction of ores. BROR CHRISTIANSEN. U. S. 1,728,784, Sept. 17. Ore such as Fe ore for producing spongy iron is passed successively through preheating, prereluction and final reduction zones of a reduction furnace (which is described) and in the final reduction zone is subjected to the action of circulating reducing gas and in the prereluction zone to the reducing action of water gas; the circulating gases are regenerated by passing them through a recarbonizing furnace for the generation of water gas required for the prereluction, hot-blasting a third recarbonizing furnace at the same time, and shifting at intervals the operation of the recarbonizing furnaces.

Smelting oxide ores. W. E. TRENT (to Trent Process Corp.). Brit. 306,949, Feb. 28, 1928. A mixt. of ore, carbonaceous fuel and flux is heated indirectly to a temp. sufficiently high to initiate reduction but below the sintering point; the charge is then passed to a smelting zone heated directly by combustion of the fuel, and the products of combustion are used for indirect heating of the reducing zone. An app. is described.

Recovery of readily volatilizable metals from sulfide ores, etc. FRIEDRICH JOHANNSEN (to Friedr. Krupp Grusonwerk A. G.). U. S. 1,728,681, Sept. 17. Recovery of metals such as Zn, Pb, Sn, Bi, As and Sb from sulfide ores, residues, etc., is effected by mixing the material with S-fiving and reducing materials such as Al_2O_3 , SiO_2 and $CaCO_3$ and subjecting the charge to direct heating in a furnace under conditions such that a reducing atm. exists in the immediate vicinity of the reacting particles of the charge; sulfides are decomposed and the oxides formed are reduced with release of the volatilizable metals and S remains fixed in the residue; the volatilized metals are oxidized in the furnace and recovered as flue dust.

Treating arsenious ore. AXEL R. LINDBLAD. U. S. 1,729,351, Sept. 24. Arsenious acid obtained during the ordinary roasting of an arsenious ore is further roasted together with calcareous material such as lime to form an arsenate and the latter is smelted with a basic slag to form an insol. product free from dangerous properties when discarded.

Apparatus for treating iron ore containing aluminum and chromium compounds. CARL A. BRACKELSBURG (to Maguire, Inc.). U. S. 1,729,534, Sept. 24. An app. is described suitable for treating the ore in the form of porous agglomerate in order to convert Al and Cr present into sol. compds., which can then be sepd. by leaching.

Treating ores such as those of lead and zinc. ROBERT W. LOVD and BERTCH W. MOYE. U. S. 1,727,472, Sept. 10. Ore is ground together with NaCl and $ZnSO_4$ and formed into a pulp soln.; sepn. is effected by "depression of the gang materials" (suitably by a flotation process which is described).

Desulfurizing zinc sulfide ores. H. J. STEHLI. Brit. 307,595, Feb. 7, 1928. See Fr. 650,078 (C. A. 23, 2924).

Reducing zinc ores. HERBERT WITTEK. U. S. 1,728,094, Sept. 10. Ores are reduced by carbide in a stream of N.

Zinc recovery from slags. HERBERT H. MAYER and ROSS G. LAMOTTE. U. S. 1,727,073, Sept. 3. In recovery of Zn from slag contg. a substantial quantity of Fe, the slag is treated with H_2SO_4 to convert the Zn and Fe into sulfates, the material is then

heated to decompose the Fe sulfate into oxide, and the ZnSO_4 is then recovered by leaching.

Recovery of tin and similar metals from smelter slags, ores, etc. HARRY V. WELCH (to International Precipitation Co.). U. S. 1,729,196, Sept. 24. A mixt. of air, a reducing agent such as powdered fuel and a halogen agent such as NaCl is introduced beneath the surface of a molten body of material such as a smelter slag to cause combustion of a portion of the reducing agent and to cause production and volatilization of the halide of the metals to be recovered. Sufficient reducing agent is used to maintain a reducing atm. in contact with the material; the metallic halide is removed in vapor form and collected. An arrangement of app. is described.

Treating copper slag. SUKESAKU YOSHIMOTO (one-third each to Torataro Okumura and Seishichiro Nakamura). U. S. 1,728,095, Sept. 10. In order to form products such as bricks or tiles, molded blocks are formed from copper slag, cooled down to a temp. of redness, a mixt. comprising mixed powders of S, mica, iron and bran is applied to the material, and the blocks are annealed by slow cooling.

Obtaining copper and nickel from mat. WM. J. HARSHAW and GEORGE L. HOMER (to Harshaw Chemical Co.) U. S. 1,729,423, Sept. 24. The mat is ground to about 10 mesh, leached with hot dil. H_2SO_4 , the residue is ground, roasted at about 400° and leached with dil. H_2SO_4 . Fresh mat is added to make up the wt. to about that of the original batch, the mixt. is leached with dil. H_2SO_4 , the residue roasted at about 400° , leached with dil. H_2SO_4 , again mixed with fresh mat to bring the wt. up to about that of the original batch, and the mixt. is further leached with dil. H_2SO_4 . The re-roastings of the residue tend to solubilize its Cu and Ni content and to facilitate complete recovery of these metals.

Gold, silver and lead recovery from antimony. SELWYN G. BLAYLOCK, JOHN J. FINGLAND and FREDERICK E. LEE (to the Consolidated Mining and Smelting Co. of Canada, Ltd.). Can. 292,971, Sept. 10, 1929. To crude Sb, substantially free from S, resulting from the reduction of Sb ores, Sb flue dusts and Sb by-products, is added sufficient Pb until the contained Ag shall not exceed 2.25% of the Pb above that required for the Au, and the contained Au shall not exceed 4% of the Pb above that required for the Ag. The mixt. is heated to a temp. slightly below its m. p. for liquating the contained Au, Ag and Pb and the temp. maintained at a degree where most of the Au, Ag and Pb, together with some of the Sb, passes through and drops from the bottom of the charge. The residue of the charge is given a further like treatment for liquating a further portion of the contained Au, Ag and Pb when the initial treatment proves incomplete, and the liquated metal is also given a further similar treatment, thus fractionating the crude Sb metal into two parts, one comprising the major portion of the contained Sb, and the other comprising the major portion of the contained Au, Ag and Pb.

Gold, silver and lead recovery from antimony. SELWYN G. BLAYLOCK, JOHN J. FINGLAND and FREDERICK E. LEE (to the Consolidated Mining and Smelting Co. of Canada, Ltd.). Can. 292,972, Sept. 19, 1929. Lead is added to melted crude Sb as in the preceding patent, the liquid mass is slowly cooled to a temp. which allows of the sepn. of a solid crust substantially impoverished in Au, Ag and Pb, leaving a liquid residue as a fractional part of the metal treated contg. the major part of the Au, Ag and Pb; the crust of this fractionation is mixed with the residual liquid of another fractionation, this admixture is fractionated, and the mixing and fractionation are repeated until the crust fraction contains the major part of the Sb, and the liquid fraction contains the major part of the Au, Ag and Pb.

Recovering gold, silver and lead from roasted or oxidized antimonial ores, etc. SELWYN G. BLAYLOCK, JOHN J. FINGLAND and FREDERICK E. LEE (to the Consolidated Mining and Smelting Co. of Canada, Ltd.). Can. 292,973, Sept. 10, 1929. Lead is added to crude Sb as in the preceding patents and then carbonaceous matter and soda ash are added, the mixt. is reduced and the reduced metal cast into a block surrounded by a considerable thickness of heat-insulating material so that the block will solidify slowly. The metals segregate into two fractions, one surrounding the other, the outer one contg. Sb metal substantially free of Au, Ag and Pb, and the inner one contg. the major portion of the Au, Ag and Pb.

Separation of gold, silver and lead from antimony ores, etc. SELWYN G. BLAYLOCK, FREDERICK E. LEE and PETER F. MCINTYRE (to the Consolidated Mining and Smelting Co. of Canada, Ltd.). Can. 292,974, Sept. 19, 1929. To roasted or oxidized Sb ores, Sb flue dust and Sb by-products are added Pb in the proportion specified in the preceding patents and a reducing agent. The slag is maintained in a fluid condition throughout the furnace treatment by the addition of a slag-forming material to sep. the charge into two fractions, one Sb metal contg. substantially all the Au, Ag

and Pb, and the other Sb soda slag. The former fraction is treated by known metallurgical methods for the recovery of the contained Au, Ag and Pb, and the latter fraction with an excess of carbonaceous material and then reduced to metal.

Treating iron pyrites. S. I. LEVY and G. W. GRAY. Brit. 307,188, Feb. 10, 1928. Pyrites is heated, in the absence of air, to about 700-900° to obtain S, the residue is treated with HCl to produce H₂S, a so called "copper-rich" residue and a chloride soln. FeCl₂ is obtained from the latter (preferably after removal of Pb by electrolysis at low voltage) and is heated (suitably to 250°) in the presence of air (with or without steam), to obtain Fe₂O₃ and HCl. Various details and auxiliary and alternative procedures are described.

Treating iron pyrites. S. I. LEVY and G. W. GRAY. Brit. 307,190, Feb. 10, 1928. Pyrites is treated with Cl at 250-1000°, the S liberated is distd. off together with the bulk of Zn and Pb chlorides formed, if the temp. is about 700-800°, and the products are separately recovered by fractional condensation. At lower temps. such as 300-450°, S is the only volatile product. The residue is treated with water to form a satd. soln. from which Cu is pptd., Pb is sep'd. electrolytically at low voltage, and Fe is deposited electrolytically with recovery of Cl for further use. Various details and alternative procedures are described.

Treating metals. GES. FÜR INDUSTRIEGASVERWERTUNG M. B. H. Fr. 659,564, Aug. 27, 1928. Fe and steel are heated to temps. suitable for annealing and then submitted to a cooling of short duration either in water or oil at ordinary temp. or in liquid air or cold air coming from an air liquefaction plant. Cf. C. A. 23, 2690.

Treating metallic oxides. SOCIETÀ ITALIANA PER LE IND. MINERARIE E CHIM. Fr. 658,752, Apr. 17, 1928. Metallic oxides are reduced with hydrocarbons to obtain the metals and other valuable hydrocarbons.

Metal founding. ALFRED RICARD, PAUL DEVICNE and ALPHONSE FOUCARD. Ger. 481,620, May 20, 1927. A method and mold for producing hollow castings are described.

Metal founding. ROBERT B. DALE. Ger. 481,621, Dec. 12, 1926. A method of producing pipe-free ingots by subjecting the cooling metal to pressure is described. Cf. C. A. 23, 3653.

Apparatus for die-casting metals supplied from crucibles. THADDEUS F. BAILY. U. S. 1,727,191, Sept. 3. Structural features.

Apparatus for "semi-automatic" casting of metals or other materials under pressure. EMILE BRUMM. U. S. 1,729,536, Sept. 24. Structural features.

Centrifugal metal-casting apparatus. CENTRIFUGAL CASTINGS, LTD., J. E. HURST and E. B. BALL. Brit. 307,152, Jan. 4, 1928. Structural features.

Centrifugal flask for casting small metal articles. RICHARD OETTINGER. U. S. 1,727,518, Sept. 10. Structural features.

Tilting multiple ingot mold for pig-iron. WILHELM BUSS. Ger. 482,041, Aug. 1, 1925.

Apparatus for teeming ferrous metals. KARL V. MCCAUSLAND. U. S. 1,727,514, Sept. 10. A ladle with a nozzle and stopper has a ring on the nozzle end of the stopper formed of a metallic reducing substance such as Al of comparatively low m. p. with respect to the metal to be teemed. The material of this ring serves to deoxidize the metal and to maintain its fluidity.

Rare metals. JOHN W. MARDEN and MALCOLM N. RICH (to Westinghouse Lamp Co.). U. S. 1,728,941, Sept. 24. In order to obtain Ta, V and Nb powder free from H and N, the oxide is heated with Ca and CaCl₂ in a sealed or evacuated container in the presence of an alkali metal.

Unicrystalline filaments of refractory metals such as tungsten. JOHANNES A. VAN LIEMPT (to General Elec. Co.). U. S. 1,728,814, Sept. 17. A unicryst. wire such as W, Mo or Ta in the form of a coil is heated in an atm. of a volatile and dissociable compd. of the same metal, such as W chloride, to a temp. at which the compd. dissociates and the liberated metal deposits on the coiled wire; the diam. of the wire is thus increased and deleterious stresses due to coiling are removed. An app. is described.

Cadmium. ROSCOE TEATS (to American Smelting and Refining Co.). U. S. 1,727,492, Sept. 10. In effecting recovery of Cd from Pb-bearing material such as bag-bonaceous material and limestone, divided into relatively fine particles, and heated at 825-850° to selectively sep. Cd from Pb as a fume, the fume is permitted to oxidize and the oxide is recovered.

Ferrosilicon. THADDEUS F. BAILY. U. S. 1,727,193, Sept. 3. SiO₂ is reduced in the presence of C to produce molten Si; Fe is separately melted in the presence of C,

and definite proportions of the molten Si and Fe are mixed to obtain ferro-Si of the desired compn. An arrangement of app. is described.

Magnesium. I. G. FARBENIND. A.-G. Fr. 34,467, Nov. 5, 1927. See Brit. 280,530 (C. A. 22, 3128).

Zinc. FRIED. KRUPP GRUSONWERK A.-G. Fr. 659,150, Aug. 20, 1928. Volatilizable metals such as Zn are obtained from ferruginous materials by treating in a rotating tubular furnace with the addn. of fuel in such excess that blocking by adherence in the furnace is avoided, the fuel remaining in the residue being recovered.

Metallurgical furnace. BENJAMIN TALBOT. U. S. 1,729,230, Sept. 24. Structural features.

Metallurgical furnace. ÉTABLISSEMENTS F. LABESSE. Ger. 481,075, June 26, 1925. Details of the construction of the fire chamber.

Bar-heating furnace. FRANK W. BROOKE. U. S. 1,727,097, Sept. 3. Structural features.

Blast-furnace operation. CHARLES L. T. EDWARDS (to Bethlehem Steel Co.). U. S. 1,727,100, Sept. 3. In reduction of ores in a blast furnace, the furnace pressure is increased by imposing back pressure in such manner as not to prevent free escape of solids entrained in the combustion gases. Structural features are described.

Blast-furnace operation. F. KRUPP A.-G. FRIEDRICH-ALFRED-HÜTTE. Brit. 306,892, Feb. 27, 1928. A cooling agent, such as water, cold blast-furnace gas, coal dust or hydrocarbons, is fed to a blast furnace at or below the junction of the zones of direct and indirect reduction and may be supplied through cooled pipes. A higher blast temp. than usual may be used.

Tuyère construction for slag-blowing furnaces. ALEX LAIST (to Anaconda Copper Mining Co.). U. S. 1,729,075, Sept. 24.

Smelting furnace suitable for treating zinc or copper ores, etc. RICHARD A. WAGSTAFF (to American Smelting & Refining Co.). U. S. 1,729,408, Sept. 24.

Tunnel furnace for annealing metal plates, roasting ores, burning ore briquets, etc. T. CARTWRIGHT. Brit. 307,522, Nov. 3, 1927. Structural features.

Rotary hearth furnace suitable for use in heat treatments. EDWARD S. FATKIN (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,750, Sept. 17. Structural features.

Furnace for heat treatment of small steel articles. IRA J. SHELTON. U. S. 1,728,371, Sept. 17. Structural features.

Purifying gases from blast furnaces. WALTHER MATHESIUS and HANS MATHE-SIUS. U. S. 1,728,130, Sept. 10. Part of the dust is sepd. from the gases by elec. pptn. and the remainder of the dust is sepd. by a wet purification process in which a fog formed in the gases while moving at low velocity is pptd. by centrifugal action. An arrangement of app. is described.

Agitating apparatus for use in refining molten pig iron. BRADLEY & FOSTER, LTD., and R. P. BETHELL. Brit. 306,670, Jan. 16, 1928. Structural features.

Iron powder. I. G. FARBENIND. A.-G. Fr. 659,796, Aug. 31, 1928. See Brit. 306,215 (C. A. 23, 4922).

Pickling iron and steel. IRA H. DERBY (to Peter C. Reilly). U. S. 1,729,097, Sept. 24. Soln. of iron and steel articles in a pickling bath such as 5% H_2SO_4 soln. is prevented by use of a sol. inhibitor such as a reaction product of P_2S_5 with alc. or cresylic acid or other suitable compd. contg. P and S.

Composition for rustproofing iron and steel. WM. H. COLE. U. S. 1,729,065, Sept. 24. A mixt. comprising emery, Cu-Zn ppt., NH_4Cl , borax, metallic Sn, naphthalene, Ni ppt., $FeCl_3$ and Al powder is used in a heat treatment for coating metal articles. Cf. C. A. 23, 1382.

Steel. EDUARD SCHLEICHER. Ger. 482,000, June 23, 1927. An alloy for molding wood-boring tools consists of 55% unmolten cast iron, 15% wrought iron, 15% white iron, 14.5% gray iron and 0.5% Al.

Rustless steels. CARL MAULER. Fr. 658,862, Aug. 10, 1928. See U. S. 1,714,035 (C. A. 23, 3435).

Rimming steel. DAVID WILLIAMS and MARCUS A. GROSSMANN (to Midwest Metallurgical Corp.). U. S. 1,727,088, Sept. 3. In order to control the quality of rimming steel, the action of the metal during solidification in the ingot mold is controlled by addn., after tapping, of a reagent such as Al, which lessens the effervescence, and by addn. to the metal in the ingot mold of a substance such as CaF_2 capable of uniting with the reagent previously added. Cf. C. A. 23, 2691.

Purification of light metals or alloys. PAUL L. HULIN. Fr. 659,879, Dec. 23, 1927. Light metals or alloys are purified by causing the molten metal or alloy to flow

through a bed of small pieces of C or Al_2O_3 or MgO to which impurities such as oxides and salts adhere.

Aluminum-silicon alloys. SOC. D'ÉLECTROCHIMIE, D'ÉLECTROMÉTALLURGIE & DES ACTIERS ÉLECTRIQUES D'UGINE. Fr. 659,675, Dec. 20, 1927. See Brit. 302,692 (C. A. 23, 4183-4).

Alloys. SOC. ANON. DE COMMENTRY-FOURCHAMBAULT ET DECAZEVILLE. Fr. 659,234, Dec. 12, 1927. See Brit. 302,249 (C. A. 23, 4183).

Magnetic alloy. WILLOUGHBY S. SMITH, HENRY J. GARNETT and JOHN A. HOLDEN. U. S. 1,728,451, Sept. 17. Alloys described comprise Fe together with Si 1-10, Cr 1-10 and C not more than 0.05%.

Alloy for high-speed steel. MONROE S. CLAWSON. U. S. 1,729,154, Sept. 24. Alloys are formed comprising W or Mo 13-40, Cr 5-20, Fe 14-75, V 0.5-3.0, Co 4-20 and C 0.85-3.5%.

Tools of hard metal alloys. KARL SCHRÖTER (to General Elec. Co.). U. S. 1,728,909, Sept. 17. Solid bodies are formed from a mixt. of very hard metal carbide powders in above 2000° such as W carbide and soft metal powders such as Co, Ni or Fe by application of pressure; these solid bodies are sintered at 700-1100° and shaped to form tools and are then sintered at a temp. above 1100° (suitably about 1400°). Cf. C. A. 23, 4185.

Alloy steel. VEREINIGTE STAHLWERKE A.-G. Brit. 307,492, March 10, 1928. An alloy steel with a low A3 point and a high elastic limit contains C not more than 0.2, Cu 0.5-1.0 and Cr 0.25-0.5% and may also contain up to 1% of Ni, W, Mo, Ti and V.

Alloy steel for dies, etc. JAMES P. GILL (to Vanadium Alloy Steel Co.). U. S. 1,727,282, Sept. 3. A steel is used comprising Co 0.5-0.9, V 0.5-1.25, C 1.5-2.5 and Cr 8-18%, the remainder being principally Fe.

Alloy steel for building material. WALTER HÜLSBRUCH (to Vereinigte Stahlwerke A.-G. Dusseldorf). U. S. 1,727,775, Sept. 10. See Brit. 271,470 (C. A. 22, 1569).

Iron alloys. ADOLF FRY (to Friedr. Krupp A.-G.). U. S. 1,729,378, Sept. 24. In order to impart high tenacity in the aged state to an Fe alloy such as that for boiler plates or tubes, the alloy is subjected to a deoxidizing action (suitably by Al, Ti, Zr, V, Mg or Si) and the degree of deoxidation is ascertained by testing a sample of the alloy in the aged state and the deoxidizing process is regulated accordingly to effect substantially complete deoxidation of the alloy. The metal may contain up to 5% Ni, Co, Cr, W, V or Mo.

Cast iron alloys. ALAN F. HILTON (to Farral Birmingham Co.). U. S. 1,729,386, Sept. 24. Cast iron alloys which are suitable for making chilled rolls contain C more than 2.25, Cu 0.25-2.0, Mo 0.1-2.0 and Cr up to 3.5%. U. S. 1,729,387 specifies cast iron alloys contg. C over 2.25, Cu 0.25-2.0 and Mo 0.1-2.0%.

Iron-silicon alloy. JAMES A. PARSONS, JR. U. S. 1,728,360, Sept. 17. An alloy which is resistant to acids contains Si 9-20, Ni 1-3, W, V or Mo 0.1-10%, sufficient C to combine with the W, V and Mo; the balance is mainly Fe.

Copper base alloys containing silicon. MICHAEL G. CORSON (to Electro Metallurgical Co.). U. S. 1,729,208, Sept. 24. Cu base alloys contg. Si 3.7-6.7% are subjected to heat treatment at 500-800° to secure a homogeneous compn. of Cu and Si which will be supersatd. at room temp; the alloy is quenched from a temp. within the range mentioned to preserve such condition of solid soln. Alloys thus treated are of improved resistance to corrosion.

Vanadium-aluminum-silicon alloys. BYRAMJI D. SAKLATWALLA (to Vanadium Corp. of America). U. S. 1,727,180, Sept. 3. Alloys which are suitable for addn. to steel comprise V 40-90, Al 3-15 and Si 5-30%, the remainder being principally Fe.

Lead alloys for sheathing electric cables. STANDARD TELEPHONES & CABLES, Ltd. Brit. 307,543, Dec. 10, 1927. An alloy of Cu with Sb is added to Pb (suitably to give a final alloy contg. Pb 98.5-99, Sb 1.2-0.8 and up to 0.5% Cu).

Magnesium-cadmium alloys. JOHN A. GANN (to Dow Chemical Co.). U. S. 1,729,339, Sept. 24. Alloys which have high strength and toughness contain Mg 90-95 and Cd 10-5%. Cu and Al also may be added in small proportions.

Wire of aluminum or aluminium alloys. VEREINIGTE ALUMINIUM-WERKE A.-G. Brit. 306,898, Feb. 27, 1928. A bar of the metal is first rolled and then drawn and a fluid such as cold air is applied to the material at its entrance to or exit from the rolling mill to prevent the temp. rising sufficiently to cause recrystn.

Uranium and its alloys. JOHN W. MARDEN (to Westinghouse Lamp Co.). U. S. 1,728,940, Sept. 24. U in stable form is obtained by reducing U oxide with Ca in the presence of $CaCl_2$ and $ZnCl_2$ and is simultaneously reduced to form an alloy of U and Zn, from which the Zn may be subsequently removed by vaporization.

Uranium-zinc alloys. JOHN W. MARDEN (to Westinghouse Lamp Co.). U. S. 1,728,942, Sept. 24. A compd. such as U oxide is simultaneously reduced and alloyed with Zn.

Hardening metals. W. MORRELL. Brit. 307,233, April 5, 1928. A mixt. for use in hardening metals such as iron, copper and brass contains rock salt 56, $K_4FeC_6N_6$ 56 parts and about 7-8 parts of naphthalene or camphor or both.

Heat treating composite wire. JOHN H. RAMAGE (to Westinghouse Lamp Co.). U. S. 1,726,679, Sept. 3. A plated metal body such as a Ni steel wire plated with Cr is covered with material such as powdered Cr and heated in H or other suitable gas inert to the covering material. The latter serves to prevent impurities from reaching the plated metal during the heat treatment. An arrangement of app. is described.

Apparatus for annealing metal articles, etc. THADDEUS F. BAILY. U. S. 1,727,192, Sept. 3. Structural features.

Apparatus (with a rotary perforated basket) for coating metal articles. HENRY B. NEWHALL. U. S. 1,727,354, Sept. 10. An app. is described, suitable for coating small articles with molten metal.

Zinc-coating iron or low-carbon steel. FREDERICK M. CRAPO (to Indiana Steel & Wire Co.). U. S. 1,726,652, Sept. 3. The articles to be coated are heat-treated sufficiently to produce annealing, immersed in a carbonizing bath of molten salts such as a cyanide bath and subsequently coated with Zn. An arrangement of app. is described.

Removing rust, scale and grease from iron and steel. W. H. COLE. Brit. 306,604, Aug. 22, 1927. See U. S. 1,715,695 (C. A. 23, 3658).

Forming tubes of sheet metal internally electroplated with a corrosion-resistant metal such as chromium. JOHN T. PRATT. U. S. 1,728,168, Sept. 10. Tubes are formed of previously electroplated sheet metal and are reinforced by an exterior pressure-sustaining tubing so as to render them suitable for use in various app. Various mech. details are described.

Lining steel drums with lead, etc. W. E. BALLARD. Brit. 307,573, Jan. 7, 1928. Mech. features.

Welding rod. JOSEPH R. DAWSON (to Electro Metallurgical Co.). U. S. 1,728,174, Sept. 17. A rod suitable for use in welding with an elec. arc or blowpipe consists of an Fe alloy contg. about 0.5% V, less than 0.2% C and about 1.2% Cr.

Welding rod. HENRY GILBERT. U. S. 1,728,052, Sept. 10. A rod suitable for welding Al or its alloys comprises Al 88.74, Cu 2.42, Cd 8.06 and Bi 0.78%.

Electrodes for arc welding. WELDRICS (1922), LTD., and A. D. ANDERSON. Brit. 306,785, July 17, 1928. An iron core is coated with a fibrous winding of a mixt. of blue and white asbestos and a paste contg. at least 95% of disintegrated blue asbestos with 5% or less of Na silicate alone or admixed with Fe oxide or china clay. The electrodes are also dipped in a soln. of K_2CO_3 and KOH and are artificially dried.

Welding railway rails. JOHN WATTMANN. U. S. 1,729,464, Sept. 24. Stretches of rails are welded together, leaving intermediate unwelded joints; the latter are subsequently welded under conditions of approx. mean atm. temp. in order to avoid undue stresses from expansion and contraction due to atm. temp. changes.

Butt-welding rails. HUGH G. SPENSBURY (to Francis Earle). U. S. 1,727,570, Sept. 10. Mech. features are described, involving application of molten metal and slag to a rail joint contg. flux and preheated to redness, followed by application of longitudinal pressure to effect union of the rail ends to be welded together. An app. is described.

Solder. JAMES SILBERSTEIN (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,772, Sept. 17. A solder suitable for soldering Cu or other metals comprises Pb 99-80 and Ti 1-20%. Cf. C. A. 23, 1106.

10—ORGANIC CHEMISTRY

CHAS. A. ROUILLER AND CLARENCE J. WEST

Advance in organic chemistry since the year 1924. ERICH LEHMANN. *Z. angew. Chem.* 42, 803-7, 820-1, 830-42, 853-6, 869-72 (1929).—A review with bibliography. E. J. C.

The nomenclature of organic compounds of complex function. AUSTIN M. PATTERSON. *Rec. trav. chim.* 48, 1012-7 (1929).—Examin. of the literature shows that it is common practice to select one function for the ending and to express the others by prefixes; the function named at the end should, as a rule, be the most important one, which may be very difficult to decide. For general purposes it would be desirable to have a criterion for deciding which function shall give the termination to the name.

For the purpose of indexing for C. A., Patterson and Curran (C. A. 11, 2467) adopted the following order of precedence: onium compds., acids (CO_2H first), acid halide, amide, imide, aldehyde, nitrile, ketone, alc., phenol, mercaptan, amine, imine, ether, sulfide (and sulfoxide and sulfone). A study of the names of the new org. compds. of complex function, described in 1923 in *Bull. soc. chim., Ber., J. Chem. Soc. and J. Am. Chem. Soc.*, and in the textbooks of Bernthsen-Sudborough, Chamberlain, Conant and Norris (2557 instances), reveals the order: onium, arsonic and stibonic, carboxylic, sulfonic, cyclic base, heterocycle, ketone, alc., arseno, azo, phenol, amine, amide, ether. The data are more indefinite for other functions but imide comes somewhat before ketone, aldehyde, arsenoxide, arsine and quinone somewhere before phenol, carbonyl halide and sulfone before ether, nitrile after cyclic base and before phenol, sulfide after carboxyl, imine somewhere after cyclic base, azoxy and diazo after ketone and thiocyanate after amine. Of course the no. of instances examined is too small to permit of more than rough qual. judgments on the relative precedence which each function has in forming org. names, but there is fair agreement between the order just outlined and the Patterson-Curran order.

C. F. VAN DUIN

Reaction of monatomic hydrogen with hydrocarbons. K. F. PONHOEFFER and P. HARTECK. *Z. physik. Chem.* 139, 64-71 (1928). When hydrocarbon vapors, CH_4 excepted, are allowed to mix with a stream of monatomic H a greenish blue light, resembling that of the inner cone of a Bunsen flame, is emitted. The products of reaction have been examined for the following substances: C_2H_2 , C_2H_4 , C_2H_6 , C_3H_4 and C_3H_6 . No change takes place in the case of CH_4 , but the evidence indicates that this gas facilitates the recombination of monatomic H according to the equations $\text{CH}_4 + \text{H} = \text{CH}_3 + \text{H}_2$, $\text{CH}_4 + \text{H} = \text{CH}_3 + \text{C}_2\text{H}_2$ gives small quantities of C_2H_2 and C_2H_4 and some CH_4 , but is mostly unchanged. C_2H_2 gives the same products as C_2H_4 with C_3H_4 in addn. C_2H_4 yields C_2H_2 , but C_2H_6 , although giving a strong light emission, gives only traces of C_2H_2 and C_2H_4 and remains practically unchanged. In the case of C_3H_6 the ring is broken, and CH_4 , together with some C_2H_2 and C_2H_4 , is formed. The results therefore show that monatomic H may hydrolyze and dehydrogenate hydrocarbons, and may rupture very stable rings.

B. C. A.

Neutral reduction of nitro compounds. W. M. CUMMING and G. S. FERRIER. *J. Roy. Tech. Coll. (Glasgow)* 2, 40-3 (1926). Neutral reduction of *p*-nitrotoluene by Zn in the presence of NH_4Cl yields *p*-hydrazotoluene readily. The same reaction proceeds only indifferently with PhNO_2 either because no appreciable intermediate formation of PhNO (I) occurs to react with the concurrently formed PhNH_2OH (II) or because II yields PhNH_2 rather than azoxybenzene, unless I is present in large excess. The general procedure was to dissolve about 1 part by wt. of the nitro compd. and 2 parts by wt. of NH_4Cl in about 12 parts by wt. of boiling 80% EtOH. The soln. was cooled to 70° and an excess of Zn dust added at such a rate that the temp. did not rise above 75° . Neutral reduction in the presence of NH_4Cl with Zn as the reducing agent proceeds via an intermediate organo zinc compd. which decomposes in boiling EtOH to yield a double basic zinc salt.

C. H. PERR

Neutral reduction and double basic zinc salts. W. M. CUMMING and G. HOWIE. *J. Roy. Tech. Coll. (Glasgow)* 2, 43-9 (1926); *cf.* preceding abstract. Reduction of nitro compds. to the corresponding azoxy compds. was carried out essentially as in the previous paper, especial care being taken to have an excess of NH_4Cl present. Reduction to the azoxy compd. proceeds via an organo zinc complex which readily decomposes to yield $2\text{NH}_4\text{Cl}$ $5\text{Zn}(\text{OH})_2$, the complex formed in the reduction of $m\text{-NO}_2\text{C}_6\text{H}_4\text{CHO}$ (I) being sufficiently stable to be isolated and proving to be $\text{ZnCl}_2 \cdot 3\text{NH}_4\text{Cl} \cdot 2\text{C}_{14}\text{H}_{10}\text{O}_2\text{N}_2 \cdot 9\text{Zn}(\text{OH})_2$. Azoxy compds. were obtained from 1- and 2-nitronaphthalene, *p*-nitrotoluene, I, *m*-nitrobenzoic acid, *m*-nitrobenzyl alcohol, *o* and *p*-nitrobenzaldehyde and some of their derivs., but the nature and conditions of formation of the intermediate double salts were detd. by studying the reduction of 1-nitronaphthalene. Replacement of NH_4Cl by other neutral salts gave naphthylamine or no reaction but no double Zn salt; hence C. and H. conclude this salt is essential to azoxy formation. Addn. of Zn^{++} as well as NH_4Cl to the reduction mixt. gave the same results. A nitro compd. or the reduction product of a nitro compd. is required for the formation of the double Zn salts described and these double Zn salts are essential to the formation of azoxy and hydrazo compds. Alc. is also necessary for the formation of the double Zn salt. All these double Zn salts are cryst. insol in H_2O , EtOH, or ZnCl_2 soln., sol. in acids, alkalis and NH_4Cl soln. They decompose above 100° . *p*-Nitrophenol thus reduced gave *p*-aminophenol; oxalate, m. 224° . Reduction of 1,1'-azoxynaphthalene to 1,1'-hydrazonaphthalene gave $9\text{Zn}(\text{OH})_2 \cdot 4\text{NH}_4\text{Cl} \cdot 6\text{H}_2\text{O}$.

C. H. PERR

The pyrolysis of methane. ARNOŠT VYSOKÝ. *Paliva a Topení* 11, 53-7 (English) 57-60(1929).—The yields of benzene from the thermal decompn. of CH_4 under various conditions were detd. quant. The CH_4 came from a natural gas from the mine Zárubek; its compn. was CH_4 94.5%, N_2 5.2%, O_2 0.3%. It was purified by passing through 2 bottles of light cylinder oil, 30% KOH, and over BaO. The gas was measured over Hg and passed into the reaction chamber. Liquid and solid products were retained in a wool-packed, H_2O -cooled U-tube. At high temps. soot collected in the U-tube also, but C_6H_6 did not. By means of a current of hot air, the products were passed into absorbing pipets. The gas leaving was also measured over Hg. I. In a quartz tube 8 and 10 mm. internal and external diams., resp., and a zone of const temp 30 mm. long, the C_6H_6 begins to appear at a temp. of $800\text{--}850^\circ$. II. The gases were exposed to the high temp. for 68 and 38 secs.; the yield of $\text{C}_6\text{H}_6 + \text{C}_7\text{H}_8$ is substantially the same for temps. above 1000° but becomes halved at 950° . For reaction times of 31, 38 and 51 secs., the yield of $\text{C}_6\text{H}_6 + \text{C}_7\text{H}_8$ remained the same. III. To det. the effect of the oxidation of H formed from CH_4 according to the equation $6\text{CH}_4 \rightarrow \text{C}_6\text{H}_6 + 9\text{H}_2$, a mixt. of CH_4 and O was passed through a reaction tube 9-11 mm. (internal and external diam.) and a const. temp. zone 40 mm. long. The rate of flow was 240 cc. per min. and the temp. $950\text{--}1050^\circ$. The yield of C_6H_6 was smaller in the presence of O than in its absence. IV. The CH_4 and O mixts. were passed through the same reaction tube into which Cu wire coils were placed close to the inner wall. No C_6H_6 or toluene was detected over a temp. range $650\text{--}1000^\circ$. The presence of Cu inhibited the formation of C_6H_6 . V. The Cu coils were replaced by Ag wire coils, the presence of Ag had no marked catalytic effect upon the reaction. VI. The reaction tube was packed with CuO , for temps. of 700° and 800° no C_6H_6 or its derivs. formed. The CuO was reduced to metallic Cu in each expt. The aromatic hydrocarbons were detd. by the method of Schulze (C. A. 23, 3189). The C_6H_6 and toluene were transformed into corresponding Br derivs. (hexabromobenzene and pentabromotoluene). These derivs. were filtered, dried at 125° and weighed.

FRANK MAREŠ.

Acetylene as raw material in the chemical industry. ERIK G. THORIN. *Tek. Tid. Kemi* 59, 83-93(1929). The manuf. of AcOH , EtOH and chlorinated products via AcH is discussed.

GERHARD RUBEN.

The relation between color and molecular structure in organic compounds. C. V. RAMAN AND S. BHAGAVANTAM. *Indian J. Physics* 4, Pt. 1, 57-78(1929).—After a review of the existing theories, R. and B. consider the relationship between color and constitution in org. compds. from a new standpoint, suggested by a comparison of the structure and phys. properties of diamond and graphite. A very general parallelism between the color and the degree of optical, elec. and magnetic anisotropy of mols. is revealed. Those structures and groups that favor the development of color also tend to enhance the degree of optical, elec. and magnetic anisotropy of the mol. The facts covered by the chromophore, quinoid and the strain theories are included in this generalization. The mechanism of light absorption is briefly discussed with reference to elec. cond. and the special type of photo-conductivity observed in illuminated crystals of high n .

H. W. LEAHY.

The ozonization of unsaturated gaseous hydrocarbons. III. Ozonization of butylenes, aldehydes and acetone. E. BRINER AND R. MEIER. *Helv. C. m. Acta* 12, 529-53(1929); cf. C. A. 23, 2149. The ozonides of the 3 butylenes and of propylene were prepd. especially to compare their hydrolysis products. Ozonization was carried out in dil. gaseous phase, both in the presence and absence of H_2O vapor as described in a previous paper, and in soln. at low temps. (Harries). Since aldehydes and Me_2CO are formed during the ozonization of butylenes, the action of O_3 on these products was also studied. To det. the yields and to follow the mechanism of the reaction, applicable anal. methods for the detection and estimation of Me_2CO and the aldehydes and acids formed were developed and are outlined. The ozonides prepd. by Harries' method were very explosive and only slightly sol. in H_2O . Hydrolysis distinguishes them from each other by the proportions of acids, aldehydes and Me_2CO produced as well as by the gas evolved; thus the ozonides of both 2,3 butylene and propylene yield CH_4 , which is characteristic of the acetic grouping, while the ozonides of isobutylene and 1,2-butylene yield chiefly H_2 , which is characteristic of the formic grouping. Isobutylene ozonide yields the peroxide of Me_2CO . These behaviors may be explained by various secondary reactions. Ozonization in the gaseous phase yielded non-explosive, water-sol. products which represent steps in the transformation of ozonides into their stable end-products—aldehydes, Me_2CO and acids. Of these intermediate products, the peroxides of HCHO (whose decompn. results in the evolution of H_2) and Me_2CO were isolated. The energy content of mixts. of unsatd. hydrocarbons and O_3 is so great

that many reactions are possible and some of these reactions terminate in the evolution of H_2 through decompn. by the H_2O participating in the reaction, as in the case above, and in the ozonization of C_2H_4 . The final transformations produced in Me_2CO , $HCHO$, AcH and $EtCHO$ by O_3 showed that $HCHO$ withstood its action but the other compds. were more or less affected with degradation to formic groupings. Yields based on O_3 , the 3 butylenes separately and a mixt. of butylenes obtained by cracking a Mexican petroleum were calcd. from the amts. of aldehydes, acids and Me_2CO obtained. These yields were somewhat lower than those found in the ozonization of C_2H_4 , the max. yield in terms of O_3 being 72% in the case of 1,2-butylene. B. and M. conclude that, since the majority of the O_3 is used because there are 3 atoms of O per mol., ozonization of unsatd. hydrocarbons constitutes an economical application of O_3 . IV. Ozonization of acetylene. E. BRINER AND R. WUNENBURGER. *Ibid* 786-90.—The action of O_3 on C_2H_2 resulted in explosions when carried out in the gaseous phase but following Harries' method a few crystals were obtained which, however, exploded before they could be investigated. Following essentially the same procedure but using very carefully dried reagents and following the reaction by very slow evapn. of solvent, a yellowish, very viscous, transparent liquid was obtained which proved on analysis to be 81% glyoxal and 5.6% HCO_2H . CO_2 was evolved in the course of the reaction so it is assumed that the remaining 13.4% was H_2O resulting from the decompn. of part of the C_2H_2 . It appears that the ozonide of C_2H_2 , if it exists, is very unstable and that its conversion is much more rapid than that of C_2H_4 . That such an ozonide does exist temporarily is indicated by the explosive material obtained by rapid evapn. of the solvent used in carrying out the reaction by Harries' method and by the presence of rapidly disappearing active O in the aq. soln. of the ozonization product. In the case of C_2H_2 the triple bond maintains the linkage of the C atoms whereas ozonization breaks the union in the case of double bonds. C. H. PEET

The additive properties of diacetylenic hydrocarbons. V. GRIGNARD AND TCHÉOU-FAKI. *Rec. trav. chim.* 48, 899-903(1929).—See C. A. 23, 4439. C. F. VAN DUIN

The reactivity of atoms and groups in organic compounds. VIII. The relative reactivities of the hydroxyl groups in certain alcohols. JAMES F. NORRIS (WITH W. S. JOHNSON, H. D. HIRSCH AND C. R. MCCULLOUGH). *Rec. trav. chim.* 48, 885-9(1929); cf. C. A. 22, 2378.—Previously the velocity of the reaction of several alcs. with $p-O_2NC_6H_4COCl$ was investigated (C. A. 19, 1244; 21, 3887) and from the results obtained certain conclusions were drawn as regards the relative reactivities of the O—H bond in these compds. In the present paper are communicated the results of the reaction of some alcs. with HBr ; this reaction involves the OH group as a whole and thus it would be possible to test experimentally the hypothesis of alternate strong and weak bonds. The results are summarized in the following table:

Alc.	A	B	C	D
Me	0.0056	0.0015
Et	0.0022	0.00031	0.0064	0.000037
Pr	0.0020	0.00044	0.0052	0.000039
Bu	0.0039	0.00041	0.0071	0.000044
Am	0.00053
iso-Bu	0.0010	0.000085	0.0054
iso-Pr	0.00040	0.00020	0.024	0.00012
sec-Bu	0.0017	0.00038	0.063	0.00038

A is the 2nd order const. at 60% conversion when the alc. and anhyd. HBr are used; concn. about 1 mol. HBr to 25 mols. alc.; temp. 100°; time in min. The reaction being reversed by the water formed during the reaction and appreciable quantities of ether being formed only toward the end of the reaction, consts. up to 60% conversion only were considered. B gives 1st order consts.; concns., HBr , 0.16 M; H_2O , 2 M; the alc. used acting as a solvent; temp. 100°; time in min. C: 2nd order consts. at 25% conversion; concns., alc., 0.1 M; HBr , 0.5 M; H_2O , 2.5 M; temp. 60°, time in hrs. D: As in C, the temp. being 25°. Conclusion: The results furnish evidence in favor of the hypothesis of alternate strong and weak bonds. C. F. VAN DUIN

Interaction of carbon tetrabromide with sulfur and selenium. HENRY V. A. BRISCOE, JOHN B. PEEL AND JOHN R. ROWLANDS. *J. Chem. Soc.* 1929, 1766-8.— CBR_4 and S, heated in a distr. flask with a free flame, give S_2Br_2 , CS_2 , Br and free C; Se yields Se_2Br_2 , $SeBr_4$ and quantities of non-volatile residue insol. in all solvents and apparently mainly a mixt. of C and Se. No indication has been observed of the more complex compds. reported by Bartal (*Ber.* 38, 3067(1905) and *Chem.-Ztg.* 1906, 810).

C. J. WEST

Ferric ethylate. Preparation and properties. P. A. THIESSEN AND O. KOERNER. *Z. anorg. allgem. Chem.* 180, 65–74 (1929).— $\text{Fe}(\text{OEt})_3$ has been prepd. in a pure cryst. state from FeCl_3 and NaOEt in abs. alc. The purity of both reagents and the abs. absence of any trace of moisture are essential features. A device is described by means of which it is possible to prep. and handle very hygroscopic crystals. The soly. of $\text{Fe}(\text{OEt})_3$ in abs. alc. and its cryst. form have been measured. The ethylate is to be used in the prepn. of pure Fe_2O_3 sols. ALBERT L. HENNE

The methanol synthesis and its theoretical basis. E. BIRK AND R. NITZSCHMANN. *Metallhölse* 19, 1350–1, 1405–6, 1462–4, 1573–5, 1629–32, 1742–4, 1798–9, 1910–2 (1929).—The development of synthetic processes for the production of MeOH is outlined, and the fundamental equations for the gas reactions involved are explained fully; 141 such equations, with deductions from them, curves involved, etc., are given. W. C. EBAUGH

Catalyst for the formation of alcohols from carbon monoxide and hydrogen. IV. Decomposition and synthesis of methanol by catalysts composed of zinc and chromium oxides. D. S. CRYDER AND PER K. FROLICH. *Ind. Eng. Chem.* 21, 867–71 (1929).—An excess of Cr_2O_3 results in the formation of appreciable amts. of CO_2 and unsatd. hydrocarbons, while with an excess of ZnO in the catalyst CO and H_2 are the main products formed, a sharp max. occurring at a catalyst compn. of approx. $\text{Zn}_{78}\text{Cr}_{22}$. The relatively const. % of HCHO formed indicates its intermediate formation in the decompn. of MeOH. Reversing the reaction, it is found that the production of MeOH from CO and H_2 parallels the formation of CO and H_2 in the decompn. expts. The results demonstrate the suitability of the decompn. method as a criterion in the selection of catalysts for the high-pressure synthesis of MeOH. Seven graphs. E. G. R. ARDAGH

Photochemical oxidation of ethyl alcohol by potassium dichromate. II. EDMUND J. BOWEN AND EDWIN T. YARNOLD. *J. Chem. Soc.* 1929, 1648–55; cf. *C. A.* 22, 57.—Measurements on the change of quantum efficiency of the reaction of EtOH and $\text{K}_2\text{Cr}_2\text{O}_7$ with the variables alc., H ion and $\text{K}_2\text{Cr}_2\text{O}_7$ concns., presence of neutral salts and temp., indicate the following conclusions: Of the ions HCr_2O_7^- , $\text{Cr}_2\text{O}_7^{2-}$ and HCrO_4^- in the soln. only the first is photoactive and then only when it has 1 or more alc. mols. attached to it. In strong EtOH solns. the quantum efficiency is approx. 1; in weaker solns. it is diminished because the presence of non-alcoholated HCr_2O_7^- ions and of $\text{Cr}_2\text{O}_7^{2-}$ ions, which by absorbing light act as "inner filters." The variation of the quantum efficiency with low EtOH concns. shows that HCr_2O_7^- ions combined with 1 or 2 EtOH mols. are photoactive, at higher EtOH concns. presumably photoactive coordinated compds. of greater complexity are formed. The fact that these compds. are photoactive and that stoichiometrically 3 EtOH mols. are oxidized for each $\text{Cr}_2\text{O}_7^{2-}$ ion reduced, necessitates the assumption that intermediate Cr compds. are formed, which react alternately with EtOH mols to complete the reduction. It is not, of course, possible to do more than to guess at their nature, but the following equation illustrates 1 possibility: $(\text{HCr}_2\text{O}_7 \cdot \text{EtOH})' + h\nu \longrightarrow \text{AcH} + \text{Cr}(\text{OH})_3 + 0.5\text{Cr}_2\text{O}_3$, followed by the interaction of the $\text{Cr}(\text{OH})_3$ with H ions and the non-photochem. oxidation of further EtOH mols by the Cr_2O_3 ion. An approx. value for the 2nd disson. const. of $\text{H}_2\text{Cr}_2\text{O}_7$ has been obtained in solns. contg. varying amts. of EtOH. The reaction between $\text{C}_2\text{H}_5(\text{OH})_2$ (I) and $\text{K}_2\text{Cr}_2\text{O}_7$ has been investigated in a preliminary way and the results show that the HCr_2O_7^- ion with 1 combined I mol. forms the photoactive substance. The values of the 2nd disson. const. of $\text{H}_2\text{Cr}_2\text{O}_7$ deduced from these measurements agree with that found from those with EtOH. No effect on the photochem. rate was produced by addn. of Na_2SO_4 but the amt. of salt which could be dissolved in the solns. of higher EtOH concn. was not very great. The effect of large quantities of CaCl_2 on the rate is small, the shift being accounted for by the removal of some of the solvent H_2O by the salt. C. J. WESS

Relative configuration of *d*- β -octanol and its *d*-rotatory halides. The interconversion of the optically active β -octanols by a new method. ARMAND J. H. HOUSSA, JOSEPH KENYON AND HENRY PHILLIPS. *J. Chem. Soc.* 1929, 1700–11.—*d*- β -Octanol (I) with HCl , HBr , HI , SOCl_2 or SOBr_2 yields *l*-rotatory halides; the configurational relationship of these halides to the parent I is still unsettled. By the aid of 2 chem. methods, which could apparently be utilized to det. the relative configurations of any optically active sec. alc. and its halides, evidence has now been obtained that I has the same configuration as the *d*-rotatory β -halogenated octanes. The principle underlying both methods is the conversion of a deriv. of the optically active alc. into (a) the alc. or an ester of the alc., (b) a halide, by closely similar reactions. The assumption is made that since the alc. (or ester) and the halide are produced under similar exptl. conditions, by reactions of the same type, they have the same configuration. *d*- C_8H_{17}

$\text{MeCHSO}_3\text{C}_7\text{H}_7$ (II) with AcOK or BzOK in EtOH give *l*- β -octyl acetate or benzoate, during which a Walden inversion occurs, since I with Ac_2O or BzCl and $\text{C}_6\text{H}_5\text{N}$ yields the *d*- β -octyl acetate or benzoate. II with LiCl in EtOH gives *l*- β -chlorooctane (III), also obtained from I and SOCl_2 . *l*- β - $\text{C}_8\text{H}_{17}\text{MeCHSO}_3\text{C}_7\text{H}_7$ (IV) and Cl in CHCl_3 give *d*- β -chlorooctane and more highly chlorinated products, the latter arising from the octylene formed in the primary reaction. IV and Cl water give, as 1 product, III. IV and Br in CHCl_3 give *d*- β -bromooctane and dibromooctane. IV and HOCl in H_2O give III and *l*- β -octanol (V). II gives no volatile products with HOCl. The formation of V from IV and HOCl proves conclusively that a Walden inversion has taken place, since IV has the same configuration as I. It can be concluded, therefore, that the production of *d*- β -chlorooctane from IV and Cl is also attended by a Walden inversion and hence that V has the same configuration as the Cl deriv. This is the same conclusion reached from a consideration of the results given by the sulfonate method. The results obtained have not been influenced by the presence of an asym. S atom in the sulfinic ester mols. The rotatory powers of the compds. prepd. by the above methods are somewhat low. The cause of this loss of rotatory power is unknown but it may be associated with the fact that octylene is a by-product of both reactions.

C. J. WEST

The preparation of methyl ether from oxides of carbon by means of catalytic hydrogenation. ARTHUR ULLRICH *Metallhorse* 19, 1741-2 (1929).—A review.

W. C. EBAUGH

Unimolecular decomposition of some ethers in the gaseous state. JOHN V. S. GLASS AND CYRIL N. HINSHELWOOD *J. Chem. Soc.* 1929, 1801-14.—The decompn. of MeOEt and MeOPr are homogeneous reactions, the rates of which are independent of pressure at high pressures and fall off at lower pressures. With MeOEt the pressure at which this falling off occurs is independent of the temp., while with MeOPr it is greater the higher the temp. Not only H, but also the products of reaction, prevent this falling off, the effect of the products being much more marked with MeOPr. $(\text{iso-Pr})_2\text{O}$ has various modes of decompn., of which 1 is a homogeneous reaction, independent of the pressure over the range investigated. At 430° , MeOEt gives 64.5% CH_4 , 33% CO and 2.5% unsatd. hydrocarbons; at 44° , there results 63.6% CH_4 , 33.8% CO, 12% CO_2 and 1.4% unsatd. hydrocarbons. MeOPr gives at 400° and 450° , 34.0 and 35.1% CO, 0.1 and 1.0% CO_2 , 2.1 and 1.9% unsatd. hydrocarbons, and 63.8 and 62.0% satd. hydrocarbons + H, resp. $(\text{iso-Pr})_2\text{O}$ gives at 550° and 566° the following products: 18.0 and 20.1% CO, 1.3 and 0% CO_2 , 67.4 and 65.0% CH_4 and 13.3 and 14.9% of unsatd. hydrocarbons. Two other reactions also occur with $(\text{iso-Pr})_2\text{O}$, a surface reaction which gives $2\text{MeCH}:\text{CH}_2$ and H_2O and a slight reaction, giving Me_2CO and C_2H_6 , which becomes the predominating mode of decompn. under the catalytic influence of iso-PrI (see following abstr.)

C. J. WEST

Homogeneous catalysis of a gaseous reaction. Kinetics of the catalytic decomposition of isopropyl ether. JOHN V. S. GLASS AND CYRIL N. HINSHELWOOD *J. Chem. Soc.* 1929, 1815-9.—The decompn. of $(\text{iso-Pr})_2\text{O}$ is catalyzed by iso-PrI; the 1 resulting from the decompn. of the iso-PrI is shown to be the effective catalyst. The reaction is completely homogeneous and its rate is proportional to the concn. of the ether and to that of the catalyst. The energy of activation is drawn from 2 "square terms" This no. is much less than that required in the uncatalyzed decompn. of the ether and corresponds to that usually found for a bimol. reaction in which the energy of activation is probably supplied by the translational energy of the colliding mols. C. J. WEST

Diethyl pentasulfides. II. G. R. LEVI AND A. BARONI *Atti accad. Lincei* 9, 903-6 (1929).—In a previous paper (C. A. 23, 4927) the prepn and properties of the pentasulfide m. 119° (I) was described. The isomer (II), m. 130° (at 26 mm.), may be prepd. by heating together 15 g. of the diethyl di-, tri- or tetra-sulfide with 3.5 g. S, in a sealed tube for 2 hrs. No products m. 130° are formed, nor any m. 119° and 130° ; the yields are 2.5 g. with the disulfide, 3.3 g. with the tri-, and 3.0 g. with the tetra-sulfide. F. p. detns. of mol. wts. in CHBr_3 gave the following results: Et_2S_4 186.8 (calcd. 186.3), I 221.1 and II 225.0 (calcd. 218.4). The following detns. also have been made:

	n_D	n_D^{20} (at 26 mm.)
Et_2S_3	1.1140 at 20°	1.56809
Et_2S_4	1.1253 at 20°	1.58436
Et_2S_5 I	1.1687 at 16°	1.60269
Et_2S_5 II	1.1620 at 16°	1.59517

A. W. CONTIERI

Aminosulfonic acid and its trisubstituted derivatives. PAUL BAUMGARTEN. *Ber.* **62B**, 820-6(1929).—The purpose of the paper is to find a rational formula for aminosulfonic acid: the discussion is based on the modifications of the acid and basic properties obtained by introduction of substituting groups on the *N* atom. *N*-Pyridinium-sulfonic acid dissolves in concd. H_2SO_4 , 70% HClO_4 or fuming HCl , and ppts. therefrom by ice water addn. in a *pure state*. The soly. in acids is due to a true salt formation. Trimethylsulfamide perchlorate, $(\text{Me}_3\text{NSO}_3\text{H})\text{ClO}_4 \cdot \text{H}_2\text{O}$ has been prepd.: it decomp. rapidly to regenerate Me_3NSO_3 and HClO_4 . With a soln. of I in KI, $(\text{Me}_3\text{NSO}_3)_2\text{KI} \cdot 2\text{H}_2\text{O}$ is formed: in this compd., the five I atoms are easily sepd. and titrated. During the prepn. of the trisubstituted derivs. by the reaction of tertiary amines with ClSO_3H , an addn. product $(\text{R}_3\text{NSO}_3\text{H})\text{Cl}$ is formed: it is unstable and eliminates HCl which combines with the excess of amine. Aminosulfonic acid

can be represented by $\text{H}_2\text{NSO}_3\text{H}$ in soln. but should be given the formula $\text{H}_3\text{NSO}_3 \cdot \bar{\text{O}}$ in solid state

ALBERT L. HENNE

Preparation of free methyl. FRITZ PANETH AND WILHELM HOFEDITZ. *Ber.* **62B**, 1335-47(1929).—Through a silica tube are led the vapors of PbMe_4 in pure H or N under 1.5-2 mm. pressure with a velocity of 12-16 m. per sec. If a section of the tube is heated for 1-2 min. with a colorless Bunsen flame, the PbMe_4 decomp. and a Pb mirror is formed, just beyond the burner. This is allowed to cool in pure H and a new Pb mirror is produced by heating the tube at a point nearer the end at which the vapors enter; as this new mirror is being formed the original one gradually disappears, the time required for its disappearance being directly proportional to the amt. of Pb in it and inversely proportional to the amt. of PbMe_4 decompd. per unit of time in forming the 2nd mirror. H alone cannot bring about this disappearance of the mirror; the substance which is formed as the result of its disappearance is stable and is extraordinarily similar in its properties to PbMe_4 . The results in pure N are the same. A Bi mirror produced from BiMe_3 can likewise be made to disappear by decompg. PbMe_4 and *vice versa*, as can also Sb and Zn mirrors produced by slowly distg. the metals from a cup in the tube in H under 0.1 mm. pressure and cooling the tube with liquid air, if necessary, at the point where the mirror is desired. The condensate of the products resulting from the disappearance of the Sb mirror consisted, after removal of the C_2H_6 , of a white substance m. below -20° and of brick-red needles, m. 13.5° . With a Zn mirror was obtained a product m. around -45° and b. around $50-65^\circ$; ZnMe_2 m. -40° , b. 46° . With S the decompn. product of PbMe_4 yields very volatile substances with the characteristic evil odor of the lower org. S compds. Neither C_2H_6 , C_2H_4 , CH_4 nor C_2H_2 , which might possibly be decompn. products of PbMe_4 , brings about a disappearance of the Pb mirror. It is concluded, therefore, that the reactive substance in all these expts. is free *methyl*. Rough measurements of the decay of its activity were made by noting the time required for the disappearance of an Sb mirror at varying distances from the point where the PbMe_4 was decompd.; in H under 2 mm. pressure the concn. of free methyl falls to 0.5 in around 0.006 sec. In view of these results it seems quite probable that in the formation of SnH_4 by means of the glow discharge in H contg. CH_4 , SnMe_4 was also present in the higher-boiling fractions of the product.

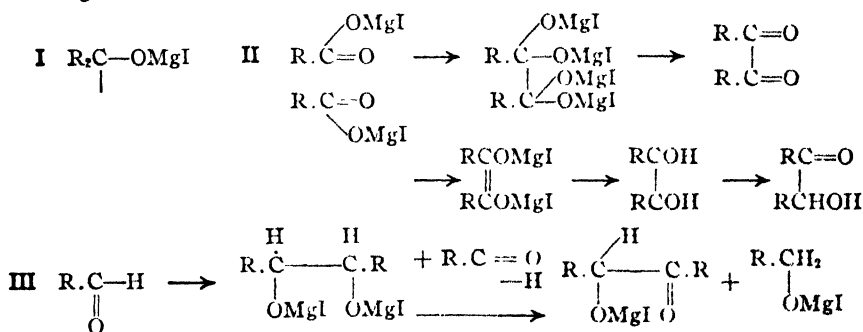
C. A. R.

The constitution of the Grignard magnesium derivatives. W. SCHLENK AND WILH. SCHLENK, JR. *Ber.* **62B**, 920-4(1929).—Several Grignard compds. have been prepd., then fractionally pptd. from their Et_2O soln. by means of $\text{O}(\text{CH}_2\text{CH}_2)_2\text{O}$. The Mg:X ratios of the fractions have been examd. Grignard compds. must be represented by $2\text{RMgX} \rightleftharpoons \text{MgR}_2 + \text{MgX}_2$. For EtI , the compn. of the Grignard deriv. would be: $6\text{EtMgI} + 4\text{MgEt}_2 + 4\text{MgI}_2$. For PhBr : $\text{PhMgBr} + 0.115\text{MgPh}_2 + 0.115\text{MgBr}_2$.

ALBERT L. HENNE

The reducing effect of the binary system ($\text{MgX}_2 + \text{Mg}$) upon organic compounds in anhydrous solvents. M. GOMBERG (with JOHN C. BAILAR, JR., and F. J. VAN NATTA). *Rev. trav. chim.* **48**, 847-51(1929).—Instead of acting in its normal additive capacity, the Grignard reagent sometimes exerts a strong reducing action, the MgI group alone and not the entire compd. RMgI adding on the CO group. An identical reduction, but even more effective than that by means of the Grignard reagent, can be accomplished by metallic Mg, provided the halide salt is also present, the simultaneous action of the 2 being essential. Seemingly the binary system of the metal and its salt is equiv. to the MgI group in the Grignard reagent. In order to carry out these reductions, Mg powder is suspended in a mixt. of 1 part of dry ether and 2 parts of dry benzene and then converted into the iodide by means of I_2 . Then the compd. to be reduced is added and finally the calcd. amt. of Mg , as powder or in the form of a

stick. *Aromatic ketones* react rapidly with this system and give rise to variously colored solns., the color being due to a small quantity of an iodomagnesium-ketyl radical (I) and being destroyed by a very small quantity of air. The presence of a radical is also shown by the fact that the reduction solns. do not obey Beer's law. When the reduction mixt. is hydrolyzed, protected from the air, the corresponding pinacols are produced in yields of 75-100%. In this connection the authors discovered that 2 crystals of I in hot AcOH are sufficient for the conversion of the pinacols into the pinacolins. *Benzil and substituted benzils* are converted into the corresponding benzoin, the dihalomagnesium salt of stilbenediols being formed as the primary reaction products and the free stilbenediols, formed on hydrolysis, rearranging to the benzoin. *Aromatic acids* are first converted into the mixed salts RCO_2MgI , which are reduced further in accordance with scheme II with the production of benzoin in 30-75% yield. *Alkyl esters of the aromatic acids* are first split into RCO_2MgI and RI , further reaction leading to the formation of benzoin according to scheme II and R and RMgI ; the yields of benzoin are about the same as from the acid itself. *Aryl esters of aromatic acids* behave in a quite different way and yield acid iodides, RCOI , and the compds. ArOMgI . *Acyl peroxides* react vigorously with iodides sol. in anhyd. org. solvents with the formation of free I and the mixed salts RCO_2MgI (cf. Gelissen and Hermans, *C. A.* 20, 2673). *Aromatic aldehydes* like BzH do not give the corresponding hydrobenzoin, but the benzoin, the hydrobenzoin-Mg salt first formed being reduced by another mol. of the aldehyde according to scheme III. BzH thus gives benzoin and PhCH_2OH , but on prolonged treatment with the binary system further reduction of the benzoin occurs through its ketonic group with the formation of tetraarylerthrols. Thus the binary system ($\text{MgX}_2 + \text{Mg}$) behaves towards the CO group in ketones, aldehydes, esters, etc., like Na and the hypothesis is put forward that this reducing power is due to the transitory formation, even at room temp., of a metastable subhalide MgX .



C. F. VAN DUIN

Inorganic side of organic chemistry. CHARLES A. KRAUS. *J. Chem. Education* 6, 1478-85(1929).—The inorg. side of org. chemistry, as illustrated by K. with metallo-org. Sn compds., comprises the study of the characteristic properties and reactions of atoms which have C groups attached to them. K. believes that certain org. derivs. of the halogens, S, N, O, etc., may well be considered from an inorg. viewpoint since they often exhibit properties which are primarily detd. by their inorg. constituents.

L. F. AUDRIETH

The formation of cyclic acetals by the action of acetone and acetaldehyde on 1,3-dihydroxylated compounds. J. BÖSEKEN. *Rec. trav. chim.* 48, 931-34(1929).—A review is given of the work done in B.'s lab by van Loon (*C. A.* 17, 1956) Hermans (*C. A.* 19, 970) and van Roon (*C. A.* 23, 1874), several smaller investigations being included.

C. F. VAN DUIN

Composition of α -eleostearic acid, the most important component of Chinese wood oil (tung oil). J. BÖSEKEN. *Tech. Univ., Delft. J. Soc. Chem. Ind.* 48, 71-2T (1929); cf. *C. A.* 22, 219, 1953, 2551.—Criticism of the paper by Steger and Van Loon (*C. A.* 23, 5050).

A. S. CARTER

Trichloroacetic acid as a cryoscopic solvent for organic compounds and binary salts. P. WALDEN. *Rec. trav. chim.* 48, 880-4(1929).—Generally org. compds. are easily sol. in $\text{CCl}_3\text{CO}_2\text{H}$, the soly. decreasing when several OH, NO_2 or CO_2H groups are present in the mol.; again, the soly. decreases with aromatic compds. in the order *o*, *m*, *p*. Inorg. compds. are only sol. with difficulty but the binary salts of quaternary

NH_4 bases are easily sol. According to Pickering (Landolt-Börnstein-Roth-Scheel, *Tabellen*, Erg. 1927, 802) the heat of fusion of $\text{CCl}_3\text{CO}_2\text{H}$ amounts to 8.63, so that the mol. depression of the f. p. would be 252. With hydrocarbons, esters and ketones, W., however, found a mol. depression of the f. p. amounting to 122 (cf. Brand and Wirsing, C. A. 6, 2622) from which a heat of fusion of 17.85 is calcd. It was shown that $\text{CCl}_3\text{CO}_2\text{H}$ is a very suitable solvent for the detn. of the mol. wt. of non-electrolytic org. compds. but that complications arise with binary quaternary NH_4 salts. The behavior of these salts varies from case to case, complete dissocn. occurring just as well as assocn. to di- and trimol. compds. For details the original paper should be consulted.

C. F. VAN DUIN

An easy method for the preparation of methionic acid. H. J. BACKER. *Rec. trav. chim.* 48, 949–52(1929).—Several methods have been published which give only small quantities of $\text{CH}_2(\text{SO}_3\text{H})_2$, only the method of Schroeter (*Ber.* 31, 2190(1898); *Ann.* 303, 114(1898); *Ber.* 38, 3389(1905); C. A. 2, 2700; 13, 3161) from C_2H_5 and fuming H_2SO_4 giving better results. B., however, obtained only a yield of 14% according to the method of S., while a 85% yield was obtained by heating 85 g. *dichloromethane*, 400 g. cryst. K_2SO_4 and 350 g. water in an autoclave at 150–160° during 2 hrs.; on cooling $\text{CH}_2(\text{SO}_3\text{K})_2$ seps. and needs only to be crystd. once from water. The K and Tl salts crystallize without H_2O ; the Ba salt and the free acid itself contain $2\text{H}_2\text{O}$, the latter m. 90.5°. At 25°, 100 g. water dissolve 245.8 g. of the anhyd. acid and 595.4 of the acid contg. $2\text{H}_2\text{O}$; 4.46, 6.42 and 0.41 g. of the cryst. K, Tl and Ba salt, resp.

C. F. VAN DUIN

Saponification of acetylated sugars and related substances. GÉZA ZEMPLÉN AND EUGEN PACSU. *Ber.* 62B, 1613 4(1929).—It had already been shown that acetylated sugars can be advantageously hydrolyzed with NaOMe and that considerably less than the calcd. amt. of NaOMe is necessary as most of the Ac is removed as MeOAc. It has now been found that with Ac compds. in whose sapon. no reducing group is set free the reaction can be carried out in MeOH on the H_2O bath and under these conditions minimal quantities of NaOMe suffice to give directly the free compds in analytically pure state. Thus 8 g. hexaacetylmannitol can be sapond. in 3 min. with 0.0046 g. Na, most of the free mannitol scpg. from the still hot soln. Very good results were also obtained with triacetyllevoglucosan, octaacetylsaccharose, octaacetylthioisotrehalose and pentaacetylsalicin. If 0.54 g. tetraacetyl- α -methylmannoside in 5 cc. cold abs. MeOH and 0.1 cc. 0.1 N NaOMe are placed on a boiling H_2O bath the free α -Me mannoside seps. in 2 min. in beautiful crystals. If the mixt. is not heated the reaction can be followed polariscopically; at room temp. it is complete in 40 min. With the Ac derivs. of reducing sugars sapon. also takes place rapidly but the solns. become yellow-brown and the resulting crystals have to be purified by recrystn. C. A. R.

Determination of the amino acids resulting from the hydrolysis of proteins. II. Acetyl esters of some amino acids. E. CHERBULIEZ AND PL. PLATTNER. *Helv. Chim. Acta* 12, 317–29(1929).—The difficulties attending the sepn. of amino acids as their esters (Fischer) led to the study of *N*-acyl derivs. of these esters as a means of sepn. Benzoylation followed by esterification by CH_3N_2 was very satisfactorily carried out but sepn. of the resulting derivs. was unsatisfactory because they would not crystallize and distn. was accompanied by decompn. The Ac esters, however, proved very satisfactory. The amino acids were esterified by treatment with abs. EtOH and dry HCl. The residue after removal of the EtOH was mixed with an equal wt. of fused NaOAc and twice its wt. of Ac_2O and heated an hr. on a water bath. Excess of Ac_2O and AcOH were removed by distn. *in vacuo* and the Ac ester was taken up in EtO or CHCl_3 and distd. *in vacuo*. Glycocol yielded $\text{AcNHCH}_2\text{CO}_2\text{Et}$, m. 48°, b_1 106°, b_2 145°; alanine yielded $\text{AcNHCH}(\text{Me})\text{CO}_2\text{Et}$, m. 38–9° (racemic, crystd. very slowly), b_1 96°, b_2 115–20°; leucine yielded $\text{Me}_2\text{CHCH}(\text{NHAc})\text{CO}_2\text{Et}$, liquid, b_1 101–3°, b_2 114°; aspartic acid yielded $\text{AcNHCH}(\text{CH}_2\text{CO}_2\text{Et})\text{CO}_2\text{Et}$, liquid, b_1 124°, b_2 180°; glutamic acid yielded $\text{AcNHCH}(\text{CH}_2\text{CH}_2\text{CO}_2\text{Et})\text{CO}_2\text{Et}$, liquid, b_1 150–60°, b_2 142°; phenylalanine yielded $\text{AcNHCH}(\text{CH}_2\text{Ph})\text{CO}_2\text{Et}$, m. 68–9° (racemic), b_2 155–7°; tyrosine yielded $\text{AcNHCH}(\text{CH}_2\text{C}_6\text{H}_4\text{OAc})\text{CO}_2\text{Et}$, m. 90° (active), $[\alpha]_D^{25}$ –16.30°, 102–3° (racemic), b_2 184°; proline yielded $(\text{C}_4\text{H}_7\text{NAc})\text{CO}_2\text{Et}$, not entirely pure, liquid, b_1 107–10°, b_2 155°, $[\alpha]_D^{25}$ –80.43°; hydroxyproline yielded $(\text{AcO C}_4\text{H}_6\text{NAc})\text{CO}_2\text{Et}$, liquid, b_2 142°; cystine yielded $[\text{SCH}_2\text{CH}(\text{NHAc})\text{CO}_2\text{Et}]_2$, m. 123–4° (active), $[\alpha]_D^{25}$ –102.3°, decomps. when distn. is attempted; cysteine yielded $\text{AcNHCH}(\text{CH}_2\text{SAc})\text{CO}_2\text{Et}$, liquid, b_2 150–1°. The Ac group is relatively stable in alk. media so for identification the acetylated amino acids may be liberated by hydrolysis of the Ac esters, preferably by $\text{Ba}(\text{OH})_2$.

C. H. PEST

Electrometric titration curves of dibasic acids. III. Substituted malonic acids. RICHARD GANE and CHRISTOPHER K. INGOLD. *J. Chem. Soc.* 1929, 1691-700; cf. *C. A.* 22, 4474.—The titer and p_H are given for a no. of alkylmalonic acids; the following figures represent the calcd. values of the apparent distance (r) between the CO_2H groups (in A. U.) and the values of the 1st ($k_1 \times 10^4$) and the 2nd ($k_2 \times 10^7$) electrometric dissoen. consts.: $CH_2(CO_2H)_2$, 1.54, 17.7, 43.7; Me deriv., 1.64, 10.75, 34.3; Et deriv., 1.50, 12.65, 28.1; Pr deriv., 1.47, 10.7, 20.8; iso-Pr deriv., 1.37, 11.7, 15.9; di-Me deriv., 1.45, 8.27, 15.3; di-Et deriv., 0.71, 62.3, 0.590; di-Pr deriv., 0.64, 86.7, 0.342. The original should be consulted for the discussion of the order of the compds., the relative intervals and the electrolytic dissoen. consts. C. J. WEST

Alkamines. III. S. KANAO. *J. Pharm. Soc. Japan* 49, 238-46(1929); cf. *C. A.* 23, 4205.—During the condensation of nitroparaffin and aromatic aldehyde, the phenol hydroxyl radical often causes the retardation. This is more so when an aldehyde possesses two OH radicals, such as resorcydaldehyde, gentisinaldehyde and protocatechualdehyde (*Ber.* 46, 1034(1913)). In order to lessen this retardation CH_3CO_2 or some other radical was substituted for OH radical. 3,4-Dihydroxybenzaldehyde (I) (100 g.), CH_3CO_2Na (100 g.) in AcOH (170 g.) gave diacetyl deriv. (II) m. 55° (yield 90%). Reduction of II (10 g.) with CH_3NO_2 (4 g.) in $KHCO_3$ gave 3,4-diacetoxyphenylaminoethanol (III), m. 155° (yield 80-90%). III (5 g.) in alc. (20 cc.) treated on the water bath with coned. acid gave 3,4-dihydroxy- ω -nitrostyrene (IV) (8 g.), m. 146-7° (yield 97%). IV (3 g.) AcOH (5 g.) in the cold treated with 30% KCl (6-7 g.) gave 3,4-diacetoxy- ω -nitrostyrene, m. 118°. Reduction of III (5 g.) with 30% AcOH (60 cc.) and Zn dust gave 1-(3,4-diacetoxyphenyl)-2-aminoethanol (yield 2.2 g.), dioxalate, m. 153°. Reduction of III (5 g.) with 35% HCHO (1.5 g.), Zn dust and AcOH gave 1-(3,4-diacetoxyphenyl)-2-methylaminoethanol, m. 168°, HCl salt, m. 155-6°. Reduction of III (3 g.) with $CH_2(CH_2)_2CHO$ (1.2 g.) by usual method gave 1-(3,4-diacetoxyphenyl)-2-heptylaminoethanol (yield 1.1 g.), dioxalate, m. 175°. III (5 g.) and PhCHO by usual method gave 1-(3,4-diacetoxyphenyl)-2-(benzylideneoximino)ethanol (V) (yield 1 g.), m. 161-2°. Reduction of V by usual method gave 1-(3,4-diacetoxyphenyl)-2-benzylaminoethanol, dioxalate, m. 168°. Reduction of III (6 g.) with $(CH_2O)_2C_6H_5CHO$ (3.2 g.) by usual method gave 1-(3,4-diacetoxyphenyl)-2-piperonylaminoethanol, dioxalate, m. 192° (yield 2.6 g.). III (6 g.), 3,4- $(CH_3CO_2)_2C_6H_5CHO$ (4.8 g.), AcOH and Zn dust treated as before gave 1-(3,4-diacetoxyphenyl)-2-(3,4-dihydroxybenzyl)aminoethanol, dioxalate, m. 201° (yield 4 g.). III (6 g.) and acetylvanillin (2.3 g.) treated as before gave 1-(3,4-diacetoxyphenyl)-2-(3-methoxy-4-acetoxybenzyl)aminoethanol, dioxalate, m. 210° (yield 2 g.). Reduction of III (6 g.) with furfural (2.6 g.) as before gave 1-(3,4-diacetoxyphenyl)-2-furylaminoethanol, dioxalate, m. 162-3° (yield 2 g.). IV. *Ibid.* 247 52(1929).—Condensation of diacetylprotocatechualdehyde (I) (3 g.) and $EtNO_2$ (1.2 g.) with $KHCO_3$ gave 1-(3,4-diacetoxyphenyl)-2-nitropropanol (II), m. 61° (yield 3.4 g.). Reduction of II (6.4 g.) with 30% AcOH (60 cc.), Zn dust and $CuSO_4$ soln. gave 1-(3,4-diacetoxyphenyl)-2-aminopropanol, dioxalate, m. 183° (yield 4.4 g.), gives positive I reaction. Reduction of II (6.8 g.) with 35% HCHO (19.6 g.) by usual method gave 1-(3,4-diacetoxyphenyl)-2-methylaminopropanol, dioxalate, m. 175° (yield 1.2 g.), gives positive I reaction. II (3 g.) treated with $CH_2(CH_2)_2CHO$ (1.1 g.) as before gave 1-(3,4-diacetoxyphenyl)-2-heptylaminoethanol, gives positive I reaction. II treated with PhCHO as before gave 1-(3,4-diacetoxyphenyl)-2-(benzylideneoximino)propanol (III), m. 118°. Reduction of III as before gave 1-(3,4-diacetoxyphenyl)-2-benzylaminopropanol, dioxalate, m. 184°, gives positive I reaction. Reduction of III (6 g.) with I (4.8 g.) as before gave 1-(3,4-diacetoxyphenyl)-2-(3,4-diacetoxybenzyl)aminopropanol, dioxalate, m. 179° (yield 3.6 g.), gives positive I reaction. Protocatechualdehyde (IV) (4 g.), CH_3NO_2 (2 g.), AcOH and Zn dust gave methyl-3,4-dihydroxybenzylideneoximide, m. 228° (yield 60%), unstable, with dil. mineral acid it decomps. into β - CH_3NHOH and aldehyde. Reduction of IV (4 g.) with CH_3NO_2 , AcOH and Zn dust gave 3,4-dihydroxybenzylmethylamine, oxalate, m. 208°, gives positive reaction for both I and $FeCl_3$. I treated with CH_3NO_2 as above gave 3,4-diacetoxybenzylmethylamine, dioxalate, m. 130°. Ethyl-3,4-dihydroxybenzylideneoximide, m. 251°, was obtained with $EtNO_2$ instead of $MeNO_2$. Other compds. obtained are 3,4-dihydroxybenzylamine, m. 205°, propyl-3,4-dihydroxybenzylideneoximide, decomps. 237°, and 3,4-dihydroxybenzylidenepropylamine, oxalate, m. 207°. All these secondary amines show positive I reaction, but not as strong as that of adrenaline, the blood contraction of these amines is also weaker than adrenaline.

F. I. NAKAMURA

The dehydrogenation of succinic acid. II. AMANDUS HAHN and W. HAARMANN. *Z. Biol.* 89, 159 69(1929); cf. *C. A.* 22, 3176.—The detn. of malic acid in presence of

large quantities of succinic acid is not accurate. It is possible, however, to det. malic acid indirectly as fumaric acid since the former is quantitatively transformed into the latter when it is heated in concd. alkali. Protein is removed by boiling. The filtrate is evapd. to dryness, the residue taken up in 50% H_2SO_4 (10 cc. for each 200 g. of muscle) and brought to a dry powder with anhyd. Na_2SO_4 . The residue of an ether ext. dissolved in NaOH upon careful neutralization, is filtered. Fumaric acid is pptd. from this with HgNO_2 . For succinic acid, the residue from the ether ext. is dissolved carefully in NaOH and treated with 4% KMnO_4 (on the water bath) until the color persists for 15 min. After SO_2 treatment, H_2SO_4 is added until the soln. is slightly acid to congo red. The mixt. is then evapd. to a small vol. (10–15 cc.), brought to a dry powder with Na_2SO_4 , extd. with ether, evapd., dissolved in NaOH, acidified with HNO_3 , pptd. with AgNO_3 (0.1 *N*) and the excess AgNO_3 titrated. With these methods, it was found that toluene has the power to enhance respiration of muscle in the presence of succinic acid without influencing its dehydrogenation by methylene blue.

FRANCES KRASNOW

Isolation of mesaconic acid from cabbage leaves. H. W. BUSTON. *Biochem. J.* 22, 1523–5 (1928).—Mesaconic acid is present in the fraction of the ether-water ext. of leaves which is pptd. by alc. and in the "dicarboxylate" fraction left after pptn. of base with phosphotungstic acid. In the former it is liberated from its Ca salt by dil. H_2SO_4 and extd. with alc. From the latter fraction, after decomp. the Ba dicarboxylates, it is extd. with alc. and purified partly by extrn. with ether and partly by pptn. as the Ca salt from this alc. ext.

B. C. A.

Action of phosphorus pentachloride on ethyl tartrate. THOMAS S. PATTERSON AND ALEXANDER R. TODD. *J. Chem. Soc.* 1929, 1768–71.— $[\text{CH}(\text{OH})\text{CO}_2\text{Et}]_2$ (I) (50 g.) was added in 2 lots to 200 g. PCl_5 and then heated 7–8 hrs. at 100° ; decompn. with H_2O and extrn. with CHCl_3 gives 20–25 g. thick, dark liquid. The product from 400 g. I, on distn. at 12–14 mm., gave 16–20 g., b. $118\text{--}25^\circ$, m. $117\text{--}8^\circ$ (dichloromaleic anhydride (II)); about 60 g., b. $127\text{--}32^\circ$ (a mixt. of Et chlorofumarate (III) and Et dichlorosuccinate (IV)), and about 16–20 g., b. $160\text{--}5^\circ$, m. $52\text{--}3^\circ$ (Et H chlorofumarate (V)). The reaction probably proceeds in stages; the first product of I is Et β -chloromaleate and the second IV, the latter passing by loss of HCl into III. III and PCl_5 may give Et chlorofumaryl chloride (VI), decompd. by H_2O to V. Further action of PCl_5 on VI may give chlorofumaryl dichloride, which, either by direct chlorination by PCl_5 or by addn. of 2 atoms Cl and subsequent elimination of HCl, might give dichlorofumaryl (or dichloromaleyl) chloride and this in turn by the action of H_2O , followed by distn., would give II.

C. J. WEST

Citric acid. G. MALCOLM DYSON. *Chemist and Druggist*, 110, 654–5 (1929).—An account of the com. prepn. of citric acid from limes and lemons; also brief reference is made to its prepn. by the fermentation of sugars through the action of *Citromyces* molds, and to the modern prepn. of malic acid.

S. WALDBOTT

The action of sodium hypochlorite on acid amides. V. I. J. RINKES. *Rec. trav. chim.* 48, 960–4 (1929); cf. *C. A.* 21, 2875.—Previously R. has already described the action of NaOCl on maleic imide; it was now found that this compd. which hitherto has always been prepd. from pyrrole, may be obtained also from an aliphatic compd., viz., by heating maleic diamide with ZnCl_2 ; it m. 93° . The ozonization of Me styryl-carbamate (obtained from cinnamic amide and NaOCl in aq. MeOH) gave BzH and *N*-carboxymethylformamide, m. 91° , b. 94° ; the homologous *N*-carboxymethylaminoacetaldehyde, however, cannot be prepd. by ozonization of allylurethan (Harries and Duvel, *C. A.* 9, 916). The degradation of the α -ketonic acid amide, BzCONH_2 , with NaOCl in H_2O gives BzOH, the Me ester being formed in MeOH soln. In the latter case the addn. of N_2H_4 gave hydrazodicarboxamide, m. 257° , which could also be obtained in this way on degradation of α -hydroxycarboxamides (Weerman, *C. A.* 8, 64) and thus the reaction of BzCONH_2 is to be formulated as follows: $\text{PhCOCONH}_2 \rightarrow \text{PhC}(\text{OH})(\text{ONa})\text{CONH}_2 \rightarrow \text{PhC}(\text{OH})(\text{ONa})\text{N}:\text{C}:\text{O} \rightarrow \text{PhCO}_2\text{Na} + \text{NaNCO}$. The degradation of α -pentenic acid proceeds in the same way as with α -nonenic acid, described previously (R., *C. A.* 21, 2874): α -pentenic acid was prepd. according to the method of von Auwers and Wissebach (*C. A.* 17, 2701) and converted into the chloride and amide, the latter m. 148° . The action of NaOCl in MeOH gave Me α -*p*-tetrylcarbamate, m. $25\text{--}6^\circ$, b. 105° , which, on hydrolysis with 15% H_2SO_4 , yields butylaldehyde (*p*-nitrophenylhydrazone, m. 86°). *o*-Nitrophenylpropionic amide, m. 159° , prepd. in the usual way, could be converted easily into *o*-nitrochlorophenyl propionic amide, m. 127° , but this compd. resisted the action of $\text{Ba}(\text{OH})_2$ and was not converted into *o*- $\text{O}_2\text{NC}_6\text{H}_4\text{CH}_2\text{CN}$, a reaction proceeding easily with the unsubstituted compd. (R., *C. A.* 15, 1510).

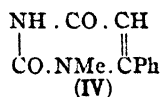
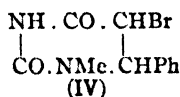
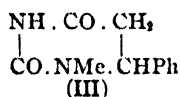
C. F. VAN DUIN

the substance is probably 2,4-diketotetrahydrothiazole 2-ketazine, $(\text{NH} \cdot \text{CO} \cdot \text{CH}_2 \cdot \text{S} \cdot \text{C} : \text{N})_2$,

rather than 3,3'-bis- ψ -thiohydantoin, $(\text{NH} : \text{C} \cdot \text{S} \cdot \text{CH}_2 \cdot \text{CO} \cdot \text{N})_2$, as formulated by F. *et al.* XIV boiled with aq. $\text{CH}_2\text{ClCO}_2\text{H}$ gives 2,4-diketotetrahydrothiazole 2-semicarbazone which is hydrolyzed by HCl to XV and semicarbazide.

Monoarylguanidines. II. **Benzoxazoleguanidine.** G. B. L. SMITH, J. H. KANE AND C. W. MASON. *J. Am. Chem. Soc.* 51, 2522-7(1929).—"o- $\text{H}_2\text{NC}_6\text{H}_4\text{NH}_2$ " should read "o- $\text{H}_2\text{NC}_6\text{H}_4\text{OH}$ " at the beginning of the abstract in C. A. 23, 4449. E. J. C.

Pyrimidines. CVIII. The synthesis of nitrogen-substituted uracils of known constitution. TREAT B. JOHNSON. *Rec. trav. chim.* 48, 872-4(1929); cf. C. A. 23, 3443.—Hydrouracils may be synthesized according to 2 methods: (1) conversion of β -amino acids into the resp. urea derivs., followed by ring closure under the influence of acids; (2) by heating urea directly with an acrylic acid (Fischer and Röeder, *Ber.* 34, 3751, 4129(1901)). *N*-substituted uracils and hydrouracils cannot be prepd. with substituted uracils by Fischer's method while direct alkylation is impossible, the pyrimidine ring being susceptible to attack by alkylating agents in 4 different positions. Hydrouracils and uracils contg. the substituent group in position 3 are now obtained by the following general method of synthesis, the example of the 3-methyl-4-phenyl compd. being described. BzH is condensed with MeNH_2 to the Schiff base which is condensed with malonic acid in mol. proportions in EtOH, the compd. I, m. 168-9°, being formed with evolution of CO_2 . I reacts quantitatively with KCNO to form the ureido acid (II) which on treatment with HCl is converted into *N*-3-methyl-4-phenyl-4,5-dihydrouracil (III), m. 158-9.5°. III and its 1-*N*-Me isomer, m. 149-50°, react normally with Br_2 to form the corresponding 5-Br substitution products, which, on treatment with pyridine or dil. alkali, are converted into the corresponding 1 or 3 substituted uracils (IV).



C. F. VAN DUIN

Dimethyldipropylalloxantin and its reduction potential. EINAR BILLMANN AND TINE TER BRAAK. *Rec. trav. chim.* 48, 919-21(1929).—Previously Billmann and Lund have shown (C. A. 17, 3126) that alloxantin and tetramethylalloxantin give well defined reduction potentials in acid soln.; these potentials are a measure of the affinity of the reactions: alloxan + $\text{H}_2 \longrightarrow$ dialuric acid + H_2O and dimethylalloxan + $\text{H}_2 \longrightarrow$ dimethyldialuric acid + H_2O . The present communication deals with dimethyldipropylalloxantin: theobromine was converted into propyltheobromine, m. 136-7°, according to van der Slooten's method (*Arch. Pharm.* 235, 486(1897)), this method giving better results than that of Brunner and Leins (*Ber.* 30, 2584(1897)) from PrI and Ag theobromine. The oxidation of propyltheobromine with KClO_3 in HCl gave methylpropylalloxan, which was reduced with H_2S to dimethyldipropylalloxantin. The reduction potential of this compd. was measured according to the method of B. and L. (l. c.) with the chain compd. $-0.1 \text{ N H}_2\text{SO}_4 - \text{H}_2$ (760 mm.), 0.3643 v. being found at 18° and 0.3616 v. at 25°. These figures were calcd. with the new values found for the potential of the quinhydrone $-0.1 \text{ N H}_2\text{SO}_4 - \text{H}_2$ (760 mm.) chain, viz. 0.7047 v. at 18° and 0.6995 v. at 25°.

C. F. VAN DUIN

Structure of a-methyl xyloside. F. P. PHELPS AND C. B. PURVES. *Bur. Standards J. Research* 3, 247-53(1929).—See C. A. 23, 4450.

C. J. WEST

Glucosides. II. The preparation of α -glucosides from β -glucosyl chlorides. WILFRED J. HICKINBOTTOM. *J. Chem. Soc.* 1929, 1676-87; cf. C. A. 23, 1881.—2-Trichloroacetyl-3,4,6-triacetyl- β -glucosyl chloride (I) does not exhibit any appreciable mutarotation in C_6H_6 , MeCN, Me_2CO , o- $\text{ClC}_6\text{H}_4\text{OH}$ or MeNO_2 after 500 hrs. and only a slight increase in rotation occurs in CHCl_3 , even after 540 hrs. Pure I may be kept for long periods exposed to the lab. atm. without any appreciable deterioration. I is stable in the presence of AgCl and is not appreciably affected in C_6H_6 by dry Ag_2O . I or 3,4,6-triacetyl- β -glucosyl chloride (II), heated in MeOH or EtOH with Ag_2CO_3 or Ag_2O , gives a mixt. of α - and β -glucosides, the proportion of α -glucoside under the most favorable conditions being approx. 70%. The rotation of II in dry MeOH rises to a max. ($[\alpha]_D$ about 160°, c 0.5) in 3 hrs. at room temp. and then gradu-

ally falls to an equil. value. In EtOH, the change of rotation is somewhat slower, the max. value being reached in about 9 hrs. I in MeOH shows a similar behavior, but the change is comparatively slow, the max. being attained only after about 50-60 hrs., to be succeeded by a slow fall to an equil. value. In EtOH and BuOH, the observations were not continued long enough for a max. or equil. to be reached. A MeOH soln. of I, which has been kept till the rotation has attained a max., still contains free I, as demonstrated by the reduction of boiling Fehling soln. and the loss of this reducing power after treatment with Ag_2O or Ag_2CO_3 ; after treatment with Ag_2CO_3 the soln. contains a mixt. of α - and β -glucosides and from it, after deacetylation, pure specimens of α - and β -methylglucosides were obtained by fractional crystn. Since a β -glucoside is derived from an α -glucosyl chloride, it is evident that the soln. contained a proportion of α -chloride, obtained from the β -chloride by isomerization due to the action of the MeOH. That the soln. of II in MeOH which has reached a max. rotation contains an excess of α -glucosyl chloride is demonstrated by the fall in rotation observed on treatment with dry Ag_2O or Ag_2CO_3 and by the isolation from the resulting soln. of pure specimens of α - and β -methylglucosides after deacetylation. Thus, the initial rise in optical rotation is detd. partly by the isomerization to the α -glucosyl chloride and partly by the reaction of the β -glucosyl chloride to yield an α -Me glucoside. With the attainment of an equil., the reaction with the solvent becomes the predominant reaction and is principally responsible for the subsequent fall in rotation. Therefore, in order to obtain α -glucosides from β -glucosyl chlorides in an approx. pure state, the exptl. conditions must be so arranged that the rate of replacement of the halogen by the alkoxy group is rapid compared with the rate of isomerization. Attempts were made to retard the rate of isomerization of I by reducing the proportion of EtOH and using an indifferent solvent as a diluent. The product resulting from condensation at room temp with MeOH in the presence of "active" Ag_2O and C_6H_6 contained a somewhat higher proportion of α -glucoside; the time for completion of the reaction is longer but the process has been successfully applied to the prepn. of the α -Ph glucoside from II. With EtOH- $\text{C}_6\text{H}_5\text{N}-\text{AgNO}_3$, the proportion of α -Me glucoside from I was raised to 90%.
C. J. WEST

Neoglucose. G. QUAGLIARIELLO AND P. DE LUCIA. *Boll. soc. ital. biol. sper.* 3, (10), 1314-5(1928).—All attempts of the authors to identify *neoglucose* in org. liquids or *in vitro* have been neg. and they deny its existence.
A. W. CONTIERI

Oxidation and decomposition of sugar. III. A theory of sugar decomposition. K. BERNHAUER. *Biochem. Z.* 210, 175-85(1929); cf. *C. A.* 23, 2699. Two types of sugar decompn. are differentiated. One type represents the process of oxidative splitting of the glucose mol. into 3-C chains which is preceded by the change into a labile form and combination with H_2PO_4 of the glucose mol. AcCHO occupies a central position in this process and AcH is a characteristic split product. This type of sugar metabolism is manifested in alc. fermentation, intramol. respiration of plants, lactic acid formation, acetic and butyric acid fermentation, etc. The other type embraces only those phenomena which have to do with the primary oxidation of the aldehyde group itself, for which either a preliminary activation or combination with H_2PO_4 is apparently not essential. The formation of glucuronic acid is of this type of reaction. IV. Behavior of glucose in solutions of sulfuric acid. *Ibid* 186-90. H_2O_2 in the presence of FeSO_4 causes considerable decompn. of glucose in soln. of H_2SO_4 . AcOH never occurs as an end product but only HCO_2H , the quantity formed being a function of the concn. of H_2SO_4 . However, in concns. above 10 N H_2SO_4 , secondary processes appear, and by the reducing capacity the quantity of glucose appears increased which may perhaps be due to a formation of disaccharides. The reaction with H_2O_2 in neutral soln., however, is stronger than in acid soln., so that the glucose seems to have been converted into a more stable form by the acid.
S. MORGULIS

Influence of bisulfite solutions on sugars at high temperatures. ERIK HÄGGLUND (with L. AHLBOM AND T. JOHNSON). *Ber.* 62B, 437-40(1929); cf. *C. A.* 23, 2945.—It was shown in the earlier paper that sugars accelerate the decompn. of bisulfite solns. into S and sulfate and that at the same time the amt. of sugar greatly diminishes. H. believes he has now cleared up the mechanism of this reaction. Glucose, heated with $\text{Ca}(\text{HSO}_3)_2 \cdot \text{SO}_2$, gives *d*-gluconic acid; under the conditions used, no other oxidation product of glucose was found. It had been concluded, in the earlier work, that in their action on bisulfite solns. sugars in some way produce thiosulfate ions; this can now be formulated thus: $2\text{HSO}_3^- + 2\text{C}_6\text{H}_{12}\text{O}_6 \longrightarrow \text{S}_2\text{O}_4^{--} + 2\text{C}_6\text{H}_{12}\text{O}_7 + \text{H}_2\text{O}$.
C. A. R.

Some properties of sugar anhydrides. AMÉ PICTET AND HANS VOGEL. *Rec. trav.*

chim. **48**, 843-6(1929).—On heating reducing sugars in a vacuum the corresponding anhydrides are obtained, *e. g.*, glucose yielding glucosan and fructose levulosan. Another kind of anhydrides was obtained from polysaccharides by heating in a vacuum, starch, *e. g.*, giving levoglucosan in this way. On heating with glycerol or glycol, however, starch is converted into a hexahexosan, a trihexosan and finally into glucosan itself while inulin yields under these conditions first a trifructosan and then levulosan. In general these anhydrides are hygroscopic compds., which are characterized by a relatively great additive power for org. compds., especially those contg. OH groups, and thus it was possible to synthesize maltose, lactose and raffinose. The easy polymerization of these anhydrides is a consequence of the same property; as a rule it takes place under the influence of heat or a catalyst but sometimes may assume a spontaneous character (galactosan). P. and V. have now tried to carry out the depolymerization of starch under the influence of glycerol or glycol in the opposite direction, *i. e.*, they have tried the synthesis of starch from glucosan, passing through the stages of trihexosan and hexahexosan. Hitherto they did not succeed in converting glucosan into trihexosan, but hexahexosan could be obtained from trihexosan under the influence of light, ultra-violet rays being especially effective. The irradiation of a concd. aq. soln. of trihexosan gave hexahexosan with 60% yield and the product was identical in every respect with that obtained by depolymerization of starch. A longer irradiation did not give a product which gave a blue color with I_2 , the reaction evidently coming to an end with the formation of the hexahexosan. The hydrolysis of the latter compd. by means of $(CO_2H)_2$ gives a dihexosan and an isomaltose. This name is applied at present to 3 different compds., *viz.* (1) the isomaltose, obtained by E. Fischer by the action of acids on glucose, (2) the compd. formed by the action of maltase on concd. solns. of glucose; (3) one of the compds. obtained by hydrolysis of starch, glycogen or dextrans. Syniewski has proposed to retain the name isomaltose for 1 and apply the names *revertose* and *dextrinose* to 2 and 3, resp. The disaccharide formed by hydrolysis of hexahexosan with $(CO_2H)_2$ is identical with the dextrinose, mentioned above, and the dihexosan which is formed in the same reaction consists of its anhydride, and thus is a *dextrinosan*, *m* 185.6°, $[\alpha]_D^{20}$ 150.7°. This dextrinosan, which is not converted into dextrinose by boiling water, is characterized by a red-brown color with I even in very dil. soln. and this observation is in accordance with those of Samec, Barger, Pringsheim and others, that the color reaction with I is not connected in any way with the colloidal state but is bound to a special constitution which apparently is that of certain hexosans. Irradiation with ultra-violet rays converts dextrinosan in hexahexosan.

C. F. VAN DUIN

Synthesis of glucosides. II. Preparation of some galactosides. ALEXANDER ROBERTSON. *J. Chem. Soc.* 1929, 1820-3; cf. *C. A.* **21**, 3602. *O*-Tetraacetylgalactosidyl bromide (I), prepd. from pentaacetylgalactose and a mixt. of Ac_2O - $AcOH$ satd. with HBr at 0°, *m* 82.3°, decomp. in moist air. p - $C_6H_4(OH)_2$ (6 g.) and 16 g. I in Me_2CO , treated with 2.4 g. KOH in 15 cc. H_2O in a N atm., give 3.2 g. *O*-tetraacetyl- β -*p*-hydroxyphenylgalactoside, *m* 202.3°; $MeOH-NH_3$ at 0° gives β -*p*-hydroxyphenylgalactoside, crystals from 75% $MeOH$ with 1.5 H_2O , *m* 246.7°, or from H_2O with 2 H_2O , *m* 246.7°, $[\alpha]_D^{20}$ -53.2° (H_2O); the anhyd. product could not be obtained pure. *O*-Tetraacetyl- β -*p*-anisylgalactoside, from I and p - HOC_6H_4OMe , *m* 104°. β -*p*-anisylgalactoside, *m* 161°, crystals from H_2O with 1 H_2O , $[\alpha]_D^{20}$ -40° (H_2O). *O*-Tetraacetyl- β -*l*-menthylgalactoside, from I and *l*-menthol, *m* 100.1°, $[\alpha]_D^{20}$ -48.6° ($CHCl_3$); *l*-menthylgalactoside, crystals with 2 H_2O , *m* 40.1°, $[\alpha]_D^{20}$ -74.2° ($R(OH)$); 1.5 mols. H_2O are lost *in vacuo* over P_2O_5 ; heating *in vacuo* causes decompn. *O*-Tetraacetyl- β -*d*-bornylgalactoside, *m* 140°, $[\alpha]_D^{20}$ 1.3° ($CHCl_3$); β -*d*-bornylgalactoside, *m* 137-8°; monohydrate, *m* 123°, $[\alpha]_D^{20}$ -6.5° ($R(OH)$).

C. J. WEST

Amides of cellulosexanthic acid. TADASHI NAKASHIMA. *Z. angew. Chem.* **42**, 543-5(1929); cf. *C. A.* **23**, 4451. Cellulosexanthoic acid (I) was prepd. by the action of $ClCH_2CO_2H$ on cellulosexanthate. If NH_3 or primary or secondary amines are added to the aq. soln. of I at room temp. the soln. gelatinizes in the course of several days, and the amide of I is formed. The product contains about 1 amide group for each C_6 residue in the cellulose and is insol. in H_2O and the usual org. solvents. The amide dissolves in alkali and gradually decomp. in soln. to regenerate cellulose. The amides prepd. were cellulosexanthoic acid anilide and its mono- and di-Et derivs., and cellulosexanthoic acid anilide and its Me derivs.

J. G. McNALLY

Polysaccharides. IV. Constitution of xylan. HORACE A. HAMPTON, WALTER N. HAWORTH and EDMUND L. HIRST. *J. Chem. Soc.* 1929, 1739-53; cf. *C. A.* **23**, 818.—

The following work was carried out with xylan (I) extd. from esparto cellulose by dil. alkali; the I content was 31% and the yield of pure I from this source 25%; under av. conditions of atm. humidity it retained about 11% H₂O. Complete hydrolysis of I with dil. HNO₃ gives 93% of the theory of cryst. xylose; it is evident, therefore, that I is composed entirely of xylose residues. I in 2.5% NaOH (c 0.89) has $[\alpha]_D^{22}$ -109.5°. I (2.5 g.) in 220 cc. 45% KOH, to which is added 15-20 cc. H₂O, treated with 200 cc. Me₂SO₄ at room temp. for 5 hrs. and then heated at 100° for 1 hr. and the resulting product remethylated, gives 95% of dimethylxylan, m. 194-5° (slight decompn.), $[\alpha]_D^{18}$ -92° (CHCl₃, c 0.5); hydrolysis gives 90% of 2,3-dimethyl methylxyloside (II), $b_{0.01}$ about 80°, n_D^{17} 1.4581, $[\alpha]_D^{21}$ 61.8° (MeOH, c 1.2), $[\alpha]_D^{22}$ 43°, equil. value after being heated in a sealed tube for 5 hrs. at 100° with 0.8% MeOH-HCl. The constitution of II was established by further methylation and hydrolysis to 2,3,4-trimethylxylose (81% yield) and by hydrolysis (85% yield) to 2,3-dimethylxylose (III), viscid sirup, n_D^{20} 1.4783, $[\alpha]_D^{20}$ 22.6° (H₂O, c 3.5) 6 min. after soln., 24° (const. value); its anilide, m. 146°, $[\alpha]_D^{19}$ 185° (AcOEt, c 0.76), which was const. for 24 hrs.; mutarotation proceeds rapidly in AcOEt contg. 4.3 g. AcOH per 100 cc. and after 1 hr. the rotation was const. at 65.5°. III does not give an osazone but on methylation gives 2,3,4-trimethylxylose, so that it cannot be the 2,5-deriv. Hydrolysis and oxidation of II with Br-H₂O give 2,3-dimethyl- γ -xylonolactone, $b_{0.01}$ 115°, n_D^{16} 1.4640, $[\alpha]_D^{22.8}$ 97° (initial value in H₂O, c 1.2); phenylhydrazide, m. 107.8°, $[\alpha]_D^{23}$ 30° (EtOH, c 0.5); *p*-bromophenylhydrazide, m. 150-1°. The rate of hydrolysis of the lactone is exceedingly slow and equil. in aq. soln. was approached only after 400 hrs. MeI and Ag₂O converts it into 2,3,5-trimethyl- γ -xylonolactone. An endeavor was made to isolate other dimethylxylosides from partly methylated I but in all cases only II was obtained. Mono-Me and unsubstituted xylose were also present in the products and it is evident that, as with starch and cellulose, there is no preferential methylation of the HO group in I. Treatment of methylated I in sealed tubes with MeI and Ag₂O results in extensive hydrolysis, unaccompanied, however, by oxidation. Thus, in I, the HO positions 2 and 3 are not involved in the mutual union of the conjugated xylose residues and positions 4 and 5 are occupied either in the linking of units or in ring formation. It is probable that it is the pyranose form of xylose which is present in I. It appears evident that β -xylose residues only are concerned in the I complex, since the sp. rotation of pure I is analogous to that of β -methylxyloside (-67°) but very different from that of α -methylxyloside (153°). Xylan differs from cellulose only in the absence of the side chain -CH₂OH from each xylopyranose unit.

C. J. WEST

The action of ultra-violet rays on aldehydes (hexahydrophenylacetaldehyde, hexahydro- β -phenylpropionaldehyde and dodecylaldehyde). FRITZ SIGMUND. *Monatsh.* 52, 185-91 (1929); cf. *C. A.* 20, 1396; Franke and Sigmund, *Monatsh.* 46, 271 (1925).—The present expts. were made in order to verify the earlier theory that in an aldehyde mol. a C double bond or a Ph group, or, even more, both together, have a stabilizing influence on the CO group, presumably by partial valencies, and that after satn., the CO group is liable to be split off under the influence of ultra-violet rays. On the radiation hexahydrophenylacetaldehyde split off gas contg. 80% CO and hexahydrotoluene was isolated from the residue. Hexahydro- β -phenylpropionaldehyde also splits off CO, but at a slower rate. The residue consisted of higher polymerization products of the aldehyde. The trimer $[C_6H_{11}(CH_2)_2CHO]_3$ was isolated. It m. 100° (uncor.). Dodecylaldehyde gave gas contg. 80% CO and in the residue C₁₁H₂₄ was identified.

G. TOENNIES

The principles of aromatic substitution from the standpoint of the electronic theory of valency. CHRISTOPHER K. INGOLD. *Rec. trav. chim.* 48, 797-812 (1929).—A review of the theoretical and exptl. work of Ingold and his collaborators on the subject of aromatic substitution. The contributions referred to are those published in the *J. Chem. Soc.* 1925-29, and *Ann. Rept.*, covering the same years.

C. F. VAN DUIN

Theories of aromatic substitution. B. FLÜRSCHHEIM. *Rec. trav. chim.* 48, 817-20 (1929).—A discussion is given of F.'s theory of aromatic substitution and that of Lapworth, Robinson and others, based on the electronic theory of valency. According to F., unequivocal predictions made on the basis of his theory have always been confirmed while strong arguments could be cited against the assumption of the participation of electrons in chem. bonds. If they do participate, however, the Lapworth-Robinson theory might conceivably form a basis for further developments, but not the hypothesis of simultaneously present alternating charges (Fry, Vorländer) against which overwhelming evidence can be adduced.

C. F. VAN DUIN

The directive power of substituents in the benzene nucleus. FRÉD. SWARTS. *Rec. trav. chim.* 48, 1025-8(1929).—Current theories of aromatic substitution assume that the activation of the C-H bond, at which the reaction takes place, is facilitated in the same measure in which the potential energy of the C-H bond is increased. This supposition is, however, not proved and the variation of the *o*-/*p*- ratio with the temp. shows that it may not be true. S. now tries to find a relation between the directive power of a substituent and its influence on the refraction: The introduction of every substituent, except F, gives an exaltation of the mol. refraction, the degree of conjugation in the benzene nucleus decreasing, while the introduction of a 2nd substituent does not give a change of general character which permits of a differentiation between *o*-, *p*- and *m*-directing substituents. When one of the substituents is F, the phenomena observed are more regular, a depression of the mol. refraction being observed with *o*-*p*-directing substituents and an exaltation with *m*-directing ones. A relation between the pos. or neg. exaltation of a substituent and its influence on the velocity of substitution cannot be traced: the greater velocity of substitution caused by the Me group and the decrease by the F atom are in harmony with the influence of these groups on the refraction but the exaltation, caused by the *m*-directing groups, is not in harmony with the retarding influence of these groups on substitution processes. Thermochem. values show that with the *p*-dichloro-, *p*-dihydroxy- and *p*-diaminobenzenes the introduction of the second substituent evolves more heat (6 cal.) than that of the 1st one, showing an increased stability. The introduction of a 3rd substituent B in $C_6H_4A_2$ gives an exaltation of the substitution heat, equal to the sums of the exaltations to the couples AB (ortho) and AB (meta), provided both the substituents A are placed in the *p*-position to each other. C. F. VAN DUIN

Synthesis of bicymyl, symmetrical *p,p'*-ditolyltetramethylethane. E. BOEDTKER AND R. KERLOR. *Compt. rend.* 188, 1681-3(1929).—The bicymyl obtained by Ciamician and Silber (*C. A.* 4, 2456) from the reaction between cymene and Ph_2CO and later isolated from raw cymene by B. and K. [*J. pharm. chim.* 9, 422(1929)] is proved to be sym. *p,p'*-ditolyltetramethylethane, m. 157°. It was synthesized as follows: PhMe (1 kg.) is treated with 150 g. of $AcCl$ and 120 g. of $AlCl_3$ to yield 100 g. of *p*-tolylacetone (I). This is transformed into $MeC_6H_4C(OH)Me_2$ and without isolation changed to the iodide, treated with powd. Zn and steam distd. to sep. the unchanged I and traces of cymene. The bicymyl remains as a spongy mass. I. M. LEVINE

Rubrene. Mechanism of formation. Description of an intermediate chlorinated derivative. CHARLES MOUREU, CHARLES DUFRASSE, AND JOSEPH ROBIN. *Compt. rend.* 188, 1582-4(1929).—Heated to 130°, $Ph_2CClC: CPh$ (I) reacts vigorously with development of much heat to give rubrene $C_{27}H_{24}$ (II) and HCl . When the reaction is moderated by cooling, there is formed besides II an intermediate compd. $C_{26}H_{22}Cl$ (III), colorless crystals, m. 217° (Maquenne block). In dry Et_2O , I also yields, during several months, II and III. When held at 70° for 30 min., I gives almost no II but considerable III. On standing in soln. or on warming, III gives II quantitatively. III is considered to have the C skeleton of II; 3 possible structures are given.

BEN H. NICOLET

The preparation of 3,4-dichlorofluorobenzene. G. M. KRAAY. *Rec. trav. chim.* 48, 1055-7(1929).—In order to convert $3,4-Cl_2C_6H_3NH_2$ into the diazonium compd., a large excess of H_2SO_4 has to be used: 1 mol. was dissolved in a boiling mixt. of 1500 cc. of water and 544 cc. concd. H_2SO_4 , the larger part of the sulfate crystg. on cooling. The mixt. was then diazotized at 0° with a concd. soln. of 75 g. $NaNO_2$ and the diazonium sulfate, thus obtained, was boiled with 1000 cc. of 55% HF in a Cu vessel. In this way a reaction product was obtained which contained $3,4-Cl_2C_6H_3OH$ which could be sepd. with dil. alkali. The remaining colorless oil, obtained with 16% yield, however, was not pure $3,4-Cl_2C_6H_3F$, the Cl content being too high (found 44.12%; calcd. 42.99%); it b₁₂ 60-80°. Fractional distn. did not give the desired $Cl_2C_6H_3F$ in a pure state, although it appeared from Cl detns. that the impurity accumulated in the higher-boiling fraction. K. suggests that the impurity consists of *o*- $C_6H_4Cl_2$ since Kalfi (*Diss. Amsterdam* 1924, 7) showed that the application of the Sandmeyer reaction to *o*- $ClC_6H_4N_2Cl$ gives some $PhCl$, the diazonium group being replaced by H. On this assumption it is calcd. from the Cl content of the several fractions that the purest product obtained contains 90.6% of $3,4-Cl_2C_6H_3F$.

C. F. VAN DUIN

The preparation of 2,5-dichlorofluorobenzene and other aromatic fluoro compounds. TH. DE CRAUW. *Rec. trav. chim.* 48, 1061-5(1929).—All attempts to prep. $2,5-Cl_2C_6H_3F$ from $2,5-Cl_2C_6H_3NH_2$ directly have failed; it was again apparent that a F atom could not be introduced in the *o*-position. The compd. was therefore prepd.

as follows: *m*-Nitroaniline was diazotized in a large excess of dil. H_2SO_4 and the diazonium soln. obtained from 0.5 mol. boiled with 560 cc. 55% HF in a Cu vessel for 0.5 hr. (yield 25%); the Cu has a deleterious effect since the addn. of Cu to the HF reduces the yield practically to zero. The $m\text{-O}_2\text{NC}_6\text{H}_4\text{F}$ was then reduced with Fe and HCl to $m\text{-FC}_6\text{H}_4\text{NH}_2$ which was acetylated to *m*-fluoroacetanilide, m. 84° , by Kaufmann's method (C. A. 4, 177). The latter compd. was chlorinated in AcOH with 1 mol. of Cl, a solid substance, m. $40\text{--}50^\circ$, being obtained with 90% yield, which was deacetylated by boiling with concd. HCl for 3 hrs. The mixt. of chlorofluoroanilines thus obtained was sepd. into its components in the following way, use being made of the different basicities of the several compds.: The mixt. of HCl salts was distd. with steam, an oil being obtained which was sepd. by distn. into 2 fractions, b. $210\text{--}5^\circ$ and $215\text{--}20^\circ$, resp. The 1st fraction solidified partly when placed in ice; the solid was filtered off and pressed between filter paper; this substance consists of 2-chloro-5-fluoroaniline, m. 26° , b. 211° , since on replacing the amino group by Cl, 3,4-Cl₂-C₆H₃F is obtained, which, on treatment with NaOMe, is converted into 3,4-Cl₂-C₆H₃OH. On acetylation 2-chloro-5-fluoroacetanilide, m. 91° , is obtained. The higher-boiling fraction solidifies on cooling and consists of 2,4-dichloro-5-fluoroaniline, m. 67° , b. $218\text{--}20^\circ$; 2,4-dichloro-5-fluoroacetanilide, m. 126° ; on replacing the NH₂ group by Cl, 2,4,5-trichlorofluorobenzene, m. 62° , was obtained; the structure of the latter compd. being proved by its conversion into 2,4,5-Cl₃-C₆H₂OH, m. 66° , by means of NaOMe. After the mixt. of HCl salts was distd. with steam (see above) until nothing more came over, alkali was added and the steam distn. continued. An oil now passed over, which partly solidified in the condenser and which consists of 3-fluoro-4-chloroaniline, m. 61° ; 3-fluoro-4-chloroacetanilide, m. 146° . Proof of the constitution was given by the conversion into 2,5-dichlorofluorobenzene, m. 2° , b.₇₆₀ 168° , since the latter compd. yields 2,5-Cl₂-C₆H₃OH by treatment with NaOMe.

C. F. VAN DUIN

Benzene and the mobility of the iodoxy group. D. VORLANDER *Rec. trav. chim.* 48, 912-8(1929).—According to Liebig (*Ann.* 26, 177(1838)) the properties of a compd. vary with the agent which is acting upon it and therefore any structure formula of benzene will be insufficient in explaining the substitution in the benzene nucleus. V. holds the opinion that primary and secondary valencies, coordination, "Aknz Beanspruchung," etc., are conceptions without real value and that hitherto the best conception about the reaction between 2 or more compds. is that developed by himself (C. A. 13, 2348) and based on the variation of the lines of force, emanating from both compds., under the influence of each other. Several factors are to be considered in this respect, e. g., satn., energy, polarity, symmetry, etc. $p\text{-O}_2\text{NC}_6\text{H}_4\text{IO}_2$ reacts with NaOH with the formation of PhNO_2 and NaIO_3 (cf. V., C. A. 19, 2935) while NaNO_2 gives $p\text{-C}_6\text{H}_4(\text{NO}_2)_2$ (cf. David, *Diss. Halle* 1928) and NaNO_3 $p\text{-O}_2\text{NC}_6\text{H}_4\text{IN}_3$. $p\text{-O}_2\text{NC}_6\text{H}_4\text{I}$ does not give any of these reactions, the cause of which is attributed to the pos. character of the I in the IO_2 group. The mobility of the IO_2 group is much greater still in 2,4-dinitroiodoxybenzene, which was obtained by oxidation of 2,4-($\text{O}_2\text{N})_2\text{C}_6\text{H}_3\text{I}$ with NaOCl in AcOH; it m. between 140° and 160° , depending on the velocity of heating. The reactions, mentioned above for $p\text{-O}_2\text{NC}_6\text{H}_4\text{IO}_2$, occur with the dinitro compd. at room temp. and 1,2,4-trinitrobenzene may be prepd. easily in this way. With 10% AcOH 2,4-($\text{O}_2\text{N})_2\text{C}_6\text{H}_3\text{IO}_2$ is converted into 6,2,4-I($\text{O}_2\text{N})_2\text{C}_6\text{H}_2\text{OH}$ (cf. Lutjert, *Diss. Halle*, 1927). These reactions are explained by the transition of crossed polarities into homogeneous ones.

C. F. VAN DUIN

Nitration of hydrocarbons in the continuous nitration plant. OTTO KREBS *Teer u. Bitumen* 27, 333-7(1929).—A continuous process for the nitration of hydrocarbons is described. Advantages of safety and simplicity are claimed. W. A. GALLUP

Scission of certain sulfohydroxamic acids. A. ANGELI, D. BIGIANTI AND Z. JOLLES. *Atti accad. Lincei* [6], 8, 116-20(1928).—According to Rsachig ("Schwefel und Stickstoffstudien," 89), the hydroxamic acid formed when Na hydroxylaminosulfonate and BzH react in presence of alkali is difficult to detect by means of the violet color with FeCl_3 because of the necessity of using a large proportion of alkali at 70° to effect the decompn. of the sulfonate. The authors find, however, that such decompn. occurs rapidly at the ordinary temp. and that the non-appearance of the color with FeCl_3 is due to reduction of this reagent to the Fe" state by the sulfito formed. Angeli, Angelico and Scurti's statement that the action of aq. KOH on naphthalene-1-sulfohydroxamic acid yields 2-C₁₀H₇SO₂H (*Gazzetta* 33, ii, 296-311(1903)) requires correction, the compd. formed being 1-C₁₀H₇SO₂H, m. 103° (cf. Hinsberg, C. A. 11, 2804).

B. C. A.

A new class of organic sulfur compounds. T. G. LEVI. *Atti accad. Lincei* 9, 790-6(1929).—In a previous note (C. A. 23, 4704) the reaction of aliphatic aldehydes with NH_4OH and H_2S , as well as aliphatic aldehydes with aliphatic amines and H_2S ,

to form thialdine and alkylthialdines was described. Similarly with arylamine, CH_2O , and H_2S are obtained basic substances contg. 2 moles of base for 1 atom of

S. By analogy a tentative formula, $\text{PhN} \cdot \text{CH}_2 \cdot \text{S} \cdot \text{CH}_2 \cdot \text{NPh} \cdot \text{CH}_2$, was assigned. However, the product does not react as tertiary but as a secondary amine, so that the constitution $(\text{PhNH})_2\text{C}_2\text{H}_4\text{S}$ is more probable. The reaction during formation may be represented as follows $2\text{PhNH}_2 + 3\text{CH}_2\text{O} + \text{H}_2\text{S} = \text{C}_{15}\text{H}_{16}\text{N}_2\text{S} + 3\text{H}_2\text{O}$. A. W. CONTIERI

The asymmetric nitrogen atom. LVII. The rotation dispersion of optically active ammonium salts. E. WEDEKIND AND G. L. MAISER. *Z. Elektrochem.* 35, 438-40 (1929); cf. *C. A.* 23, 1641.—*d*- and *l*- $\text{Ph}(\text{C}_6\text{H}_5\text{Me})(\text{C}_6\text{H}_5)\text{MeN}$ salts (iodide, *d*-camphor-sulfonate and nitrate) and the free base showed absence of anomalous rotation dispersion. Rotation of these salts is due entirely to asym. N. Similar results were obtained with other salts tested. A. P. SACHS

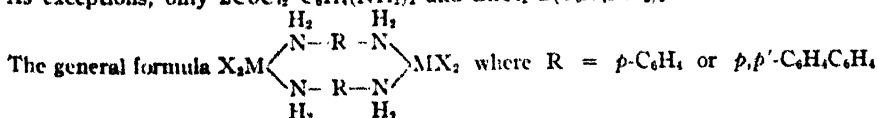
The action of guanidine bicarbonate on the acid sodium sulfite addition products of benzylideneanilines. JOHN B. EKELEY AND MARGARET C. SWISHER. *Rec. trav. chim.* 48, 1052-4(1929).—The reaction between mol. quantities of $\text{PhCH} \cdot \text{NPh}$ and NaHSO_3 in H_2O gives an addn. product which is only stable when in the mother liquor and begins to decomp. when removed therefrom. The aq. soln. of such addn. products reacts with 1 mol. of guanidine bicarbonate with the immediate pptn. of an *anilino-benzyl guanidine bisulfite* (I), $\text{PhNHCHPhOSO}_2\text{NH}_2\text{C}(\text{NH}_2)_2$, which, on heating with acids, decomp. into SO_2 , $\text{PhCH} \cdot \text{NPh}$ and a guanidine salt. A similar reaction takes place when aminoguanidine bicarbonate or urea hydrochloride is used instead of a guanidine salt. The following esters of *guanidine bisulfite* are described: *anilino-benzyl*, m. 143° ; *anilino-p-tolyl*, m. 172° ; *anilino-o-nitrophenonyl*, m. 205° ; *anilino-piperonyl*, m. 163° ; *p-toluidinobenzyl* (H.O.), m. 148° ; the anhyd. compd. also m. 148° ; *p-toluidino-piperonyl*, m. 169° ; *p-toluidino-p-tolyl*, m. 176° ; *p-di-iminophenylene-bis-benzyl*, m. 155° . The same compds. may be prepd. also: (1) by dissolving the aromatic amine in an aq. soln. of the aldehyde- NaHSO_3 addn. product and addn. of the guanidine bicarbonate soln.; (2) on adding the calcd. quantity of the amine and the aldehyde to a guanidine bicarbonate soln. and passing SO_2 through the mixt.

C. F. VAN DUIN

The nitration of esters of methylphenylcarbamic acid. P. VAN ROMBURGH. *Rec. trav. chim.* 48, 922-5(1929).—The action of HNO_3 on esters of PhNHCO_2H gives rise to the formation of di- and trinitro compds. with out introduction of a nitro group in the amino group and without splitting off the CO₂R group (v. R., *Rec. trav. chim.* 10, 135(1891)). The action of HNO_3 on esters of $\text{MePhNCO}_2\text{H}$ gives the same results, trinitro derivs. being obtained only by continued boiling with HNO_3 . These trinitro compds. were obtained also by the action of MeI on the Ag salts of trinitrophenylcarbamic esters. *Me N-methylphenylcarbamate* (I), prepd. from PhNHMe and ClCO_2Me in H_2O or ether, m. 44° , b₇₆₀ 243° . Nitration of I with the ten-fold amt. of HNO_3 (d. 1.40) gives the *p*-nitro compd. of I, m. $110-1^\circ$, which was obtained also from *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{NHMe}$ and ClCO_2Me and, on boiling with dil. alkali, produces *p*- $\text{O}_2\text{NC}_6\text{H}_4\text{NHMe}$, m. 151° . With HNO_3 of d. 1.50, I gives *Me N-methyl-2,4-dinitrophenylcarbamate*, m. 98° ; on heating with concd. HCl in a sealed tube at 150° , 2,4-(O_2N)₂ $\text{C}_6\text{H}_3\text{NHMe}$, m. 178° , is obtained. The 2,4,6-trinitro compd. was obtained: (1) by nitration of 1 part of I with a mixt. of 7.5 parts HNO_3 (d. 1.5) and 5 parts concd. H_2SO_4 for 48 hrs. at room temp.; (2) by the action of MeI in boiling MeOH on a suspension of the Ag salt of 2,4,6-(O_2N)₃ $\text{C}_6\text{H}_2\text{NHCO}_2\text{Ag}$. This compd. crystallizes in needles, m. 107° , and in compact crystals, m. 118° (cf. Jaeger, *Z. Krist.* 42, 27(1906)). The following Et esters were prepd. by methods analogous to those mentioned above for the Me esters: *methylphenylurethan*, b₇₆₀ 250° ; *methyl-p-nitrophenylurethan*, m. 45° ; *methyl-2,4-dinitrophenylurethan*, m. 112° and *methyl-2,4,6-trinitrophenylurethan*, m. 65° .

C. F. VAN DUIN

The constitution of compounds formed of a metallic salt and *p*-phenylenediamine or benzidine. WALTER HIEBER AND KARL RIES. *Z. anorg. allgem. Chem.* 180, 105-9 (1929).—*p*- $\text{C}_6\text{H}_4(\text{NH}_2)_2$ forms complex salts with chlorides which are much more stable than those obtained from the *o*-deriv. In nearly all cases, the compn. of the complex salt is represented by $\text{MX}_2 \cdot \text{C}_6\text{H}_4(\text{NH}_2)_2$ (M = Zn, Cd; X = Cl, Br, I; X₂ = SO₄). As exceptions, only $2\text{CoCl}_2 \cdot \text{C}_6\text{H}_4(\text{NH}_2)_2$ and $\text{ZnCl}_2 \cdot 2(\text{C}_6\text{H}_4\text{NH}_2)_2$ have been obtained.



is proposed. The no. of coordination valences was detd. by the NH_3 substitution method.

Nitrogen derivatives of abietic acid. J. DUBOURG. *Bull. inst. pin* 1929, 138-47.— Cf. C. A. 22, 593.

Chemical behavior of organic diamines with respect to the formation of complex salts. WALTER HIEBER, CLARITA SCHLIESZMANN AND KARL RIES. *Z. anorg. allgem. Chem.* 180, 89-104(1929).— $o\text{-C}_6\text{H}_4(\text{NH}_2)_2$ has been made to react with the chlorides and sulfates of Co, Ni, Cu, Zn and Cd. Compds. have been found which contained 1, 2, 3, 4 and 6 mols. of diamine per 1 mol. of metallic salt. Their behavior in H_2O shows their poor stability. In concd. solns., complex ions can be detected: cond. measurements and their anal. behavior show that they are completely dissoed. into their constituents in dil. solns. The diamine occupies only 1 coordination place, as can be shown by NH_3 replacement. The only exceptions are CuNO_3 and CuSO_4 (which combine with 2 mols. of amine), and $\text{CdCl}_2 \cdot \text{C}_6\text{H}_4(\text{NH}_2)_2$. So far as coordination valence is concerned, $o\text{-C}_6\text{H}_4(\text{NH}_2)_2$ is comparable to $o\text{-C}_6\text{H}_4(\text{OH})_2$; both differ from glycol and $(\text{CH}_2\text{NH}_2)_2$ by the poor stability of their complex compds. ALBERT L. HENNE

Organometallic compounds. I. A new class of aryltin derivatives. Phenyl-trihalostannane. K. A. KOZESHKOV. *Ber.* 62B, 996-9(1929).—One mol. Ph_3Sn and 3 mols. SnCl_2 are heated in a sealed tube at $210\text{--}20^\circ$ for 2 hrs. These conditions are optimum to obtain PhSnCl_3 (80% yield), $b_{765} 245\text{--}310^\circ$ (decompn.), $b_{25} 142\text{--}3^\circ$, decompd. slowly by atm. moisture, sol. in ice-cold H_2O , decompd. quickly by tepid H_2O . Adding NH_4OH or alk. solns. to the cold aq. soln. causes a ppt. sol. in an excess of alkali. Cold concd. HBr or aq. HI react with an ice-cold concd. soln. of PhSnCl_3 to give PhSnBr_3 , $b_{25} 182\text{--}3^\circ$, or PhSnI_3 , unstable. Heating PhSnCl_3 with concd. H_2SO_4 gives C_6H_6 and SnCl_4 . Br acts very slowly. Adding NH_3 or pyridine to a dry soln. of PhSnCl_3 in Et_2O gives mol. addn. compds. PhSnCl_3 and SnCl_2 at 220° in a sealed tube give quant. Ph_2SnCl_2 , m. 42° . Ph_3SnCl is obtained quant. by simply modifying the proportions used to prep. PhSnCl_3 . ALBERT L. HENNE

Mercurio-organic compounds. I. New method for the synthesis of aromatic mercurio-organic salts. A. N. NESMEYANOV. *Ber.* 62B, 1010-8(1929).—To prep. compds. of the RHgX type (R = aromatic radical, X = halogen), the corresponding $\text{RN}_2\text{X} \cdot \text{HgX}_2$ compds. are heated with Cu dust in alc. or, preferably, Me_2CO . The following table lists the aromatic radicals, the % yield and the m. p. In each case, $\text{X} = \text{Cl}$. Ph , 51, 258° ; $p\text{-MeC}_6\text{H}_4$, 66, $238\text{--}9^\circ$; $o\text{-MeC}_6\text{H}_4$, 66, 143° ; $\alpha\text{-C}_{10}\text{H}_7$, 58, 191° ; $\beta\text{-C}_{10}\text{H}_7$, 47, 270° ; $p\text{-HOC}_6\text{H}_4$, 56, $226\text{--}7^\circ$; $o\text{-MeOC}_6\text{H}_4$, 72, $180\text{--}1^\circ$; $p\text{-EtOC}_6\text{H}_4$, 77, $249\text{--}50^\circ$; $o\text{-HOCC}_6\text{H}_4$, 56, $184\text{--}5^\circ$; $p\text{-ClC}_6\text{H}_4$, 46, 240° ; $p\text{-BrC}_6\text{H}_4$, 45, 249.5° ; $p\text{-IC}_6\text{H}_4$, 45, 272.5° ; $2,5\text{-Cl}_2\text{C}_6\text{H}_3$, 15, 208° ; $2,4,6\text{-Br}_3\text{C}_6\text{H}_2$, 0, —; $p\text{-NO}_2\text{C}_6\text{H}_4$, traces, $267\text{--}9^\circ$; PhH_2I , 40, 269° . II. New method for the preparation of symmetrical aromatic mercurio-compounds. A. N. NESMEYANOV AND E. I. KAHN. *Ibid* 1018 20.—This new method is based on the reaction: $2\text{ArN}_2\text{I} \cdot \text{HgCl}_2 + 6\text{Cu} = \text{Ar}_2\text{Hg} + \text{Hg} + 6\text{CuCl} + 2\text{N}_2$. The procedure consists in mixing 10 g. $\text{ArN}_2\text{I} \cdot \text{HgCl}_2$ with 8 g. Cu in 50 cc. ice-cold EtOH or, preferably, Me_2CO , allowing the mixt. to react, adding an equal vol. of 25% aq. NaOH , allowing to stand for 12-24 hrs., adding H_2O and filtering. The following table lists the compds. prepd., the yield and the m. p. Ph_2Hg , 65, 125° ; $(\alpha\text{-C}_{10}\text{H}_7)_2\text{Hg}$, 53, 249° ; $(p\text{-MeC}_6\text{H}_4)_2\text{Hg}$, 76, $243\text{--}4^\circ$; $(p\text{-BrC}_6\text{H}_4)_2\text{Hg}$, 70, $243\text{--}4^\circ$; $(p\text{-IC}_6\text{H}_4)_2\text{Hg}$, 70, $270\text{--}2^\circ$; $(2,5\text{-Cl}_2\text{C}_6\text{H}_3)_2\text{Hg}$, 20, 237° ; $(o\text{-MeOC}_6\text{H}_4)_2\text{Hg}$, 60, 108° ; $(p\text{-NO}_2\text{C}_6\text{H}_4)_2\text{Hg}$, 10, 320° . ALBERT L. HENNE

The halogen substitution products of thyronine (desiodothyronine). K. SCHURGRAF. *Helv. Chim. Acta* 12, 405-14(1929).—The halogen substitution products of thyronine (I) ($\text{HOC}_6\text{H}_4\text{OC}_6\text{H}_4\text{CH}_2\text{CH}(\text{NH}_2)\text{CO}_2\text{H}$) have been prepd. in which the 2 pairs of I atoms of thyroxine (3,5 and 3',5') have been replaced systematically by Cl or Br, giving 9 different compds. Their physiol. effect is similar to, though less marked than that of thyroxine (cf. Abderhalden and Wertheimer, C. A. 23, 3748). These derivs., together with new compds. prepd. and used in their prepn., are as follows: 3,5-Diiodo-3',5'-dibromothyronine, m. $245\text{--}6^\circ$ (decompn.), insol. in boiling EtOH or glacial AcOH , sparingly sol. in 15% hot HCl , slightly more in dil HCl ; 3,5-diiodo-3',5'-dichlorothyronine, m. 262° (decompn.), insol. in EtOH , slightly in boiling AcOH , sparingly in 15% HCl , readily in dil. HCl ; 3,5-dibromo-4-[4'-methoxyphenoxy]nitrobenzene, yellowish prisms, m. $151\text{--}2^\circ$, insol. in H_2O , slightly in EtOH and Et_2O , readily in C_6H_6 , CHCl_3 , AcOH and MeCCl_2Et ; 3,5-dibromo-4-[4'-methoxyphenoxy]aminobenzene, m. 117° ; 3,5-dibromo-4-[4'-methoxyphenoxy]benzonitrile, m. 107° ; 3,5-dibromo-4-[4'-methoxyphenoxy]benzaldehyde, m. 98° ; 4-[3',5'-dibromo-4'-(4'-methoxyphenoxy)benzylidene]-2-phenyl-5-oxazolone (azlactone), $\text{Br}_2(\text{MeOC}_6\text{H}_4\text{O})\text{C}_6\text{H}_4\text{CH}:\text{C}:\text{N}:\text{CPh}:\text{O}:\text{CO}$, m.

195°; 3,5-dibromothyronine, m. 257° (decompn.), insol. in EtOH, slightly in glacial AcOH, sol. in hot 15% HCl; 3,5,3',5'-tetrabromothyronine, m. 241-2° (decompn.), insol. in 15% HCl and EtOH, slightly in dil. HCl and in hot glacial AcOH; 3,5-dibromo-3',5'-diiodothyronine, m. 229° (decompn.), insol. in HCl and EtOH, slightly in hot glacial AcOH; 3,5-dibromo-3',5'-dichlorothyronine, m. 234° (decompn.), very slightly sol. in hot EtOH, hot glacial AcOH and boiling 15% HCl; 3,5-dichloro-4-[4'-methoxyphenoxy]nitrobenzene, m. 147°; 3,5-dichloro-4-[4'-methoxyphenoxy]aminobenzene, m. 144°; 3,5-dichloro-4-[4'-methoxyphenoxy]benzonitrile, m. 97°; 3,5-dichloro-4-[4'-methoxyphenoxy]benzaldehyde; 4-[3',5'-dichloro-4'-[4"-methoxyphenoxy]benzylidene]-2-phenyl-5-oxazolone, m. 191°; 3,5-dichlorothyronine, m. 266° (decompn.), insol. in EtOH, slightly in 15% hot HCl, sol. in hot glacial AcOH; 3,5,3',5'-tetrachlorothyronine, from IX, m. 231° (decompn.), hardly sol. in 15% hot HCl, slightly in hot 2% HCl, sol. in glacial AcOH and in hot EtOH; 3,5-dichloro-3',5'-diiodothyronine, m. 229° (decompn.), insol. in 15% HCl, slightly sol. in 2% HCl, EtOH and hot glacial AcOH; 3,5-dichloro-3',5'-dibromothyronine, m. 240° (decompn.), slightly sol. in hot 2% HCl and boiling EtOH, sol. in hot glacial AcOH.

G. CALINGAERT

Trichloro- and the higher chlorophenols and their electrical conductivity in water. G. J. TIESSENS. *Rec. trav. chim.* **48**, 1066-8(1929).—The replacement of the NH₂ group in the benzene nucleus by the diazonium reaction sometimes affords considerable difficulty and it is quite conceivable that the more or less basic character of the substituted aniline in question is of influence. It is therefore of interest to measure the elec. cond. of these anilines, but for practical purposes it is more convenient to investigate the corresponding phenols. The prepn. of the phenols investigated will be described elsewhere; only the prepn. of 2,3,6-trichlorophenol is given. *p*-C₆H₄Cl₂ was first mononitrated and the nitro compd. reduced to the amine, which, after acetylation, was nitrated to a mixt. of 1,4-dichloro-2-acetyl-amino-5- and 3-nitrobenzenes which were sepd. by means of boiling benzene (cf. Beilstein and Kurbatow, *Ann.* **196**, 221(1879)). The latter compd. was deacetylated, converted into the corresponding Cl₂C₆H₂NO₂, which was again reduced to the amino compd., 2,3,6-Cl₃C₆H₂NH₂. The conversion of this aniline into the corresponding phenol presented great difficulties, the best yield, 15%, being obtained when, working with 0.1 mol. of the aniline, steam was passed through the soln. contg. CuSO₄ and a large amt. of Na₂SO₄; the crude phenol had to be distd. twice with steam; it m. 58°, from ligroin. The following figures were obtained at 25° for *k* × 10¹⁰: phenol, 1.3; *o*-ClC₆H₄OH, 360; *p*-ClC₆H₄OH, 210; 2,4-Cl₂C₆H₃OH, 310; 2,3,4-Cl₃C₆H₂OH, m. 83.5°, 252; 3,4,5-Cl₃C₆H₃OH, m. 101°, 45; 2,3,6-Cl₃C₆H₃OH, m. 58°, 7360; 2,3,5-Cl₃C₆H₃OH, m. 62°, 500; 2,4,5-Cl₃C₆H₃OH, m. 68°, 430; 2,4,6-Cl₃C₆H₃OH, m. 69°, 3900; 2,3,4,5-Cl₄C₆H₂OH, m. 116°, 1100; 2,3,4,6-Cl₄C₆H₂OH, m. 70°, 72,000; 2,3,5,6-Cl₄C₆H₂OH, m. 115°, 33,000; Cl₆COH, m. 144°, 55,000. From these figures it is quite obvious that the presence of 2 Cl atoms in the *o*-positions to the OH group has a predominating influence over all else, the relatively small effect of Cl atoms in the vicinal position being remarkable; this is brought out particularly in the Cl₄C₆H₂OH. The ionization consts. found above are only relative. Considered as abs. values they may be marred with fairly large errors since the sp. cond. of the water used and that of many of the solns. are of the same order of magnitude. The difficult convertibility of 2,3,6-Cl₃C₆H₂NH₂ into the corresponding phenol cannot be explained by the small basicity of the aniline since higher chlorinated anilines, which are even less basic, undergo this reaction much more easily.

C. F. VAN DUIN

The nitration of aromatic compounds in alcoholic solution. FRÉDÉRIC REVERDIN. *Rec. trav. chim.* **48**, 838-42(1929).—According to D. R. P. 164,130 (Friedländer, *Fortschritte der Teerfarbenfabrikation* **8**, 108) *p*-substituted aryl- and alkoxysulfonamides may be nitrated in the *o*-position by treatment with HNO₃ of d. 1.185 in H₂O or alc. (In this abstr. *o*-position always means ortho with respect to the substituted amino group.) Phenacetin, when treated in this way, gives a diazo compd., the NHAc group being sapond., but with HNO₃ of d. 1.40, 2-nitrophenacetin, m. 103-4°, is obtained. On heating benzoyl-*p*-anisidine in alc. with HNO₃ of d. 1.185 on the water bath during 2 hrs., 2-nitrobenzoyl-*p*-anisidine, m. 141°, is obtained in excellent yield, the same result being obtained with HNO₃ of d. 1.40. On the other hand, *p*-anisylurethan yields the 2-nitro compd., m. 65°, on treatment in alc. with HNO₃ of d. 1.185 but the 2,6-dinitro compd., m. 163°, when HNO₃ of d. 1.40 is used. In the latter case the dinitro compd. is not the sole reaction product, the mononitro compd. being obtained at the same time. The dinitro compd. is obtained as the sole product from *p*-toluenesulfonyl-*p*-phenetidine (m. p. of the dinitro compd., 166-7°) and HNO₃ of d. 1.40, while *o*-nitro-*p*-toluenesulfonyl-*p*-phenetidine is converted into the 2,6-dinitro compd., m. 163°.

under these conditions (cf. Reverdin and Fürstenberg, *C. A.* **7**, 3314). On sapon. wit. concd. H_2SO_4 at 80° both these dinitro compds. yield 4,2,6- $\text{HO}(\text{O}_2\text{N})_2\text{C}_6\text{H}_2\text{NH}_2$, m. 230° . C. F. VAN DUIN

Nitroveratroles. H. VERMEULEN. *Rec. trav. chim.* **48**, 969 72 (1929).—The nitration of 4-nitroveratrole (5 g) with 17 cc. HNO_3 (d. 1.51) gives 4,5-dinitroveratrole, m. $130-1^\circ$, in theoretical yield provided the nitration be carried out at 0° ; at room temp. a small quantity of 3,4,5-trinitroveratrole is formed at the same time. On dissolving 4-nitroveratrole in HNO_3 (d. 1.43) a compd., m. 102° , is obtained, which, according to Pschorr and Silberbach (*Ber.* **37**, 2151 (1904); cf. *Rec. trav. chim.* **25**, 25 (1906)) consists of 4-nitroveratrole. On nitration with a mixt. of HNO_3 (d. 1.5) and concd. H_2SO_4 , this compd. is converted into 3,4,5-trinitroveratrole, m. 145° , and as its N content lies between the N content of a mono- and a dinitroveratrole, the substance m. 102° probably consists of a mixt. or compd. of 4-nitro- and 4,5-dinitroveratrole. Moreover, a mixt. of 4 parts 4-nitroveratrole and 5 parts 4,5-dinitroveratrole gives on crystn. from alc. the same mol. compd., m. 102° . Thus it appears that the 4-nitroveratrole of P. and S., m. 102° , consists of a mixt. of the 4-nitro- and the 4,5-dinitro compds. The reduction of 4-nitroveratrole with SnCl_2 gives 4-aminoveratrole, m. $87-8^\circ$ acetylation of this compd. yielding 4-acetamidoveratrole, m. 130 (Fargher, *C. A.* **14**, 2917 gives 136). The nitration of 4-acetamidoveratrole in AcOH with HNO_3 (d. 1.40) gives 1-acetamido-5-nitroveratrole, m. 197° , the structure being proved by the formation of 4-nitroveratrole on eliminating the HNAc group. The same compd. may be obtained from 4,5-dinitroveratrole by reduction with SnCl_2 to 4-amino-5-nitroveratrole, m. $169-70^\circ$, followed by acetylation. On nitrating 3-nitroveratrole with HNO_3 (d. 1.5) a mixt. of di- and trinitroveratroles is obtained, which may be sep'd. by crystn. from AcOEt into 3,4,5-trinitroveratrole, m. 145° , a dinitroveratrole, m. 101° , and 3,4-dinitroveratrole, m. 90° (cf. Jones and Robinson, *C. A.* **12**, 135; Pollecchi and R., *C. A.* **12**, 2314; Oxford, *C. A.* **21**, 376). On reduction with SnCl_2 , 3-nitroveratrole gives an oily amino compd. which on acetylation passes into 3-acetamidoveratrole, m. 84° . The nitration of the latter compd. with HNO_3 (d. 1.45) gives 3-acetamido-5-nitroveratrole, m. 173° , and a small amt. of 3-acetamido-4,5-dinitroveratrole, m. 240° . Reduction of 3,5-dinitroveratrole with SnCl_2 yields 3-amino-5-nitroveratrole, m. 107° , which on acetylation yields the 3-acetamido-5-nitro compd. described above. C. F. VAN DUIN

Aromatic allyl and propenyl compounds. III. Isosafrole dibromide. H. I. WATERMAN and R. PRIESTER. *Rec. trav. chim.* **48**, 941 3 (1929). Isosafrole dibromide was obtained as an oil by Wallach and Pond (*Ber.* **28**, 2719 (1895)), and by Foulds and Robinson (*C. A.* **8**, 3782) while Hoering and Baum (*C. A.* **3**, 2946) record a m. p. of 51° and Mannich (*Arch. Pharm.* **248**, 166 (1910)) of $52-3^\circ$. Naraï (*C. A.* **16**, 418) obtained dark brown viscous oils by brominating *cis*- and *trans*-isosafroles, but W. and P. have already proved that *cis*-isosafroles are mixts. of safrole and isosafrole (*C. A.* **22**, 3643; **23**, 1123) and thus his results need not be considered further although they are mentioned in the literature. When starting from a com. isosafrole and using the bromination method of F. and R. (*l. c.*) in CS_2 a viscous oil was obtained which could not be distd. in a vacuum, decompn. occurring with evolution of HBr and the formation of bromoisosafrole, it is inadvisable to distil larger quantities at a time in this way, spontaneous decompn. being possible. Isosafrole, purified by means of the addn. compd. with picric acid, however, gave an oily dibromide, which may be distd. in a special cathode light vacuum (details are to be published later by Waterman and Silberbach) provided the bath temp. does not rise above 60° . A colorless oil distd. which on cooling solidified and showed the m. p. $52-53^\circ$, and d_4^{20} 1.7682, n_D^{20} 1.6095. C. F. VAN DUIN

The influence of position isomerism on some specific constants. N. SCHOORL. *Rec. trav. chim.* **48**, 935 37 (1929).—Several spec. const. may be considered to be more or less additive such as the mol. refraction, the mol. refractive coeff. (Eisenlohr, *C. A.* **15**, 3081) and the parachor (Sugden, *C. A.* **20**, 386). S. has prep'd. the 3 isomeric cresols in a state of great purity by freezing out com. products to const. setting point, the figures 29.3° , 8.0° and 33.6° being obtained for the *o*-, *m*- and *p*-compd., resp. The detn. of the phys. const. gave the following results: d_4^{20} 1.0465, 1.0336, 1.0341; n_D^{20} 1.5452, 1.5398, 1.5395; surface tension 40.3, 39.6, 39.2; mol. refraction (Gladstone-Dale) 56.28, 56.40, 56.34 (calcd. 55.9); mol. refraction (Lorenz-Lorentz) 32.64, 32.77, 32.74 (calcd. 32.45); parachor 258.8, 261.0, 260.2 (calcd. 266.1); mol. refractive coeff. 166.9, 166.3, 166.27 (calcd. 164.2). The largest difference between the isomers amounts to 0.21% for the mol. refraction (Gl.-D.); to 0.40% for the

mol. refraction (L.-L.); to 0.38% for the mol. refractive coeff. (E.) and to 0.84% for the parachor. From these results it follows that the mol. refraction, calcd. according to Gl. and D., is the least and the parachor the most sensitive for position isomerism. The increase of the mol. refraction in the order *o-p-m* is not found with other position isomerides, Kalf (Diss. Amsterdam 1924) having found the order *o-m-p* for the dichlorobenzenes and van Woerden (Diss. Leiden 1924) the same order for the isomeric methylhexahydroacetophenones. Rykman (Rec. trav. chim. 12, 177(1893)) also found the order *o-m-p* for the 3 cresols but the specimens investigated were only purified by fractional distn. in a vacuum and thus were less pure than those of Schoorl.

C. F. VAN DUIN

***p*-Bromobenzoylacetone, its isonitroso derivatives and the corresponding dioxime.**

J. HANUŠ, A. JÍLEK AND J. LUKAS. Collection Czechoslovak Chem. Communications 1, No. 7, 392-6(1929).—*p*-Bromobenzoylacetone is synthesized by mixing, in a round-bottom flask equipped with a reflux condenser, 201 g. *p*-BrC₆H₄COMe, 550 cc. abs. Et₂O, 25 g. Na wire and 221 g. EtOAc. The reaction at first is violent and must be moderated by cooling, but when completely abated it is heated on a water bath for 1 or 2 hrs. Exposed in an open vessel for 24 hrs., the crude compd. is pptd. from the ether soln. in the form of small colorless crystals, which, when washed several times with Et₂O and dried on a porous plate, forms a yellowish cryst. mass. It is purified by dissolving in the required amt. of water, filtering and acidifying with AcOH. The yield of colorless cryst. compd. is 62 g. from 100 g. of BrC₆H₄COMe. Crystd. from boiling alc. it forms brilliant, very slightly greenish flakes which m. 94.6°. Isonitroso-*p*-bromobenzoylacetone is prepd. by adding dropwise a mol. of satd. aq. NaNO₂ to a mol. of *p*-bromobenzoylacetone in Ac₂O. The reaction should be only slightly cooled so as to prevent the pptn. of the unattacked *p*-bromobenzoylacetone. The isonitroso compd. can be freed from the unattacked compd. with CS₂ which dissolves the latter but not the former. Washed free of acid, dried on a porous plate, freed from *p*-bromobenzoylacetone by washing with hot CS₂, and crystd. from hot CHCl₃, it forms bright prisms or large leaflets which m. 169-70°. The yield of the purified compd. is 50.5 g. from 100 g. of the initial ketone. It dissolves in cold alc. or Et₂O, less in cold benzene, CHCl₃ and CCl₄, but dissolves readily in these solvents when warmed. Its alc. soln. products, in the presence of a slight amt. of NH₃, a yellow ppt. with Ag salts which dissolves in an excess of NH₃. It reduces Cu salts with discoloration, and with Pd salts it forms a light colloidal ppt. sol. in dil. HCl. It does not ppt. other metals. None of the pptns. are quant. The *oxime* of the isonitroso-*p*-bromobenzoylacetone is prepd. by adding 8 g. NH₄OH and 11 g. NaOAc to 1.0 g. isonitroso-*p*-bromobenzoylacetone dissolved in 1.0 cc. of hot alc., and dissolving this mixt. in the least amt. of water, and warming the filtered soln. for 1.5 hrs. on a water bath. Poured into cold water, an oil is deposited which slowly changes to a cryst. mass. Washed with CHCl₃, a yield of 44 g. of a slightly greenish cryst. powder is obtained from 100 g. of the initial isonitroso compd. The crude product is purified by crystn. from xylene followed by a washing with CHCl₃. The pure compd. m. 189-90°, and it is readily sol. in alc. and is not pptd. by the addn. of water. Its alc. soln. produces, in a faintly NH₃ medium, a yellow ppt. with Ag salts, the ppt. being sol. in an excess of NH₃. With Pd salts it forms a yellow ppt. slightly sol. in dil. HCl. Salts of Cu, Ni and Co form in faintly NH₃ soln. as brown pptns. These pptns. are not quant. The formation of a *tri-oxime* was attempted but the resulting compd., which m. 147.8°, had the compn. of a dioxime and seemed to be an isomer of the dioxime described above. Its reactions with the cations were identical.

CHARLES J. PEDERSEN

The reactivity of positized hydrogen atoms. II. Benzyl ketone. W. DUTHY AND BIRGIT STALLMANN. Ber 62B, 1603-9(1929); cf. C. A. 21, 2885.—The observations of Goldschmidt and of Hertzka that only one CH₂ group of (PhCH₂)₂CO reacts with aldehydes was confirmed with piperidine (I) as the condensing agent and BzH, anisaldehyde and piperonal as the aldehydes. The end products are not the ethylene compds., RCH(CPh)COCH₂Ph, but their piperidine addn. products which contain 1 mol. I per ethylene union; the yield is quant. only when at least 1 mol. of I is used for the condensation. The properties of these (colorless) addn. products indicate that they are not mol. compds., as previously assumed, but formed by addn. at the C-C bond, for they slowly dissolve in cold dil. acids and are repptd. unchanged by NH₄OH. They are always mixts. and the products obtained from BzH and anisaldehyde were sepd. into 2 isomers which it was at first thought might be the 2 theoretically possible addn. products RCH(NC₃H₇O)CHPhCOCH₂Ph (II) and RCH₂C(NC₃H₇O)PhCOCH₂Ph (III), and attempts were made to prep. them by addn. of I to the ethylene compds. but the latter do not add I under the conditions of the con-

densation. This suggested that the I is brought in from the aldehyde or ketone side, and as $(\text{PhCH}_2)_2\text{CO}$ does not react with I in alc. at room temp. the structure III is excluded and the isomers must be the 2 *dl*-compds. to be expected of II with its 2 asym. C atoms. Although they could not be resolved into optical antipodes, this view as to their structure was confirmed by the fact that I and BzH readily yield benzylidenedipiperidine which with $(\text{PhCH}_2)_2\text{CO}$ in alc. gives a compd. identical with that obtained by direct condensation of the ketone and BzH in the presence of I. The colorless dipiperidine compd. of dibenzaldiphenacyl sulfide described in the 1st paper probably has the structure $[\text{PhCH}(\text{NC}_6\text{H}_{10})\text{CHBz}]_2\text{S}$ while the yellow-red compd. of the salicylaldehyde product was presumably a salt. 1,2,4-Triphenyl-1-piperidino-3-oxobutane (II, R = Ph) (3 g. from 1 g. BzH, 2 g. $(\text{PhCH}_2)_2\text{CO}$ and 1 g. I) is sepd. by crystn. from C_6H_6 into isomers m. 147° 8' and 121° 2', partially sol. in cold dil. acids, sol. in concd. H_2SO_4 without color but soon turning yellow; *picrates* (not sepd. from each other), yellow, m. 132° 8'. With hot acids these addn. products give $\text{PhCH}:\text{CPh}:\text{COCH}_2\text{Ph}$, m. 86°. 1-[4'-Methoxyphenyl]-1-piperidino-2,4-di-phenyl-3-oxobutane (II, R = MeOC_6H_4) (3.7 g. from 2 g. ketone and 1 g. $\text{MeOC}_6\text{H}_4\text{CHO}$) m. 126° and 156°; *picrate*, green-yellow, m. 147° 8'. 1-[3',4'-Methylenedioxy] analog m. 135° 50'; no attempt was made to sep. the isomers. 1-[4'-Dimethylaminophenyl] compd., m. 143° 5', yields *p*-dimethylaminobenzaldehyde *dibenzyl ketone*, yellow, m. 110°, when the I is split off. Addn. products were also obtained from the three $\text{O}_2\text{NC}_6\text{H}_4\text{CHO}$ or their dipiperidino derivs. but no solid intermediate products contg. I were obtained from *o*- $\text{HOC}_6\text{H}_4\text{CHO}$, its NO_2 or Br derivs. or $\text{HOOC}_6\text{H}_4\text{CHO}$; through the reaction of the other CH_2 group, with elimination of H_2O , ring closure and formation of chromone derivs. occurs. $\text{PhCH}:\text{CHCHO}$ gives directly Wieland's triphenylcyclohexenone. *Piperonaldipiperidine*, from the components in the cold, m. 69° 71', is sensitive to moisture. *p*-Nitrobenzaldipiperidine, faintly yellowish, m. 86° 8'. *m*-Isomer, m. 93° 5'. *o*-Compd., yellow, m. 73° 5', deliquesces in the air. III. Contribution to the question of catalytic reactions. W. DILTHEY. *Ibid* 1609-12.—As shown above, the reaction between BzH, piperidine and $(\text{PhCH}_2)_2\text{CO}$ can be split up into the 3 reactions: $\text{BzH} + 2\text{HNC}_6\text{H}_{10} \rightarrow \text{PhCH}(\text{NC}_6\text{H}_{10})_2 + \text{H}_2\text{O}$ (I); $\text{PhCH}(\text{NC}_6\text{H}_{10})_2 + \text{CO}(\text{CH}_2\text{Ph})_2 \rightarrow \text{PhCH}(\text{NC}_6\text{H}_{10})\text{CHPhCOCH}_2\text{Ph} + \text{HNC}_6\text{H}_{10}$ (II); $\text{PhCH}(\text{NC}_6\text{H}_{10})\text{CHPhCOCH}_2\text{Ph} \rightarrow \text{PhCH}:\text{CHPhCOCH}_2\text{Ph}$ (III). All 3 reactions can be experimentally realized and all the intermediate products can be isolated and identified by starting directly with the aldehyde, ketone and piperidine. The question arises, therefore, whether piperidine under these conditions can be considered as a catalyst. The principal step in the process is reaction II but reaction I is undoubtedly a prerequisite and the driving force. The course of the process depends chiefly on the aldehyde-piperidine compd.; if it is very stable, like *m*-nitrobenzaldipiperidine, more than 2 weeks may be required for the sepn. of the piperidine addn. product of the ethylene compd., whereas the labile acetaldehyde-piperidine yields the corresponding piperidino deriv. almost instantly.

C. A. R.

Influence of substituents on the Reimer-Tiemann reaction. II. HERBERT H. HODGSON AND THOMAS A. JENKINSON. *J. Chem. Soc.* 1929, 1639-42; cf. *C. A.* 23, 2957.—By using the previous method, the following *o/p* ratios were obtained with CHBr_3 and CHCl_3 : PhOH , 0.44, 0.6; *o*- $\text{MeC}_6\text{H}_4\text{OH}$, 0.37, 0.48; *o*- $\text{ClC}_6\text{H}_4\text{OH}$, 0.71, 1.6; *o*- $\text{BrC}_6\text{H}_4\text{OH}$, 0.65, 1.25; *o*- $\text{IC}_6\text{H}_4\text{OH}$, 0.65, 1.07; *o*- $\text{HOC}_6\text{H}_4\text{CO}_2\text{H}$, 0.05, 0.06; *m*- $\text{MeC}_6\text{H}_4\text{OH}$, 0.85, 0.46; *m*- $\text{ClC}_6\text{H}_4\text{OH}$, 0.84, 0.71; *m*- $\text{BrC}_6\text{H}_4\text{OH}$, 0.77, 0.72; *m*- $\text{IC}_6\text{H}_4\text{OH}$, 0.84, 0.78. The difference in the 2 reactions may be explained by assuming that the less energetic cationoid reagent derived from CHBr_3 has a greater sp. vol. than that derived from CHCl_3 . With CHI_3 , the *o/p* ratio for PhOH and its *o*-halogen derivs. ranged from 0.2 to 0.3, showing the overwhelming effect of steric conditions upon the very feeble cationoid reagent.

C. J. WESR

Reimer-Tiemann reaction with *m*-fluorophenol and the nitration of 4-fluoro-2-hydroxy- and 2-fluoro-4-hydroxybenzaldehydes. HERBERT H. HODGSON AND JOSEPH NIXON. *J. Chem. Soc.* 1929, 1632-9.—The following compds. were prepd. by methods previously described (cf. *C. A.* 22, 949). *m*- $\text{FC}_6\text{H}_4\text{OH}$ (15 g.), 36 g. NaOH , 36 g. CHCl_3 and 120 cc. H_2O give 3.5 g. 4-fluoro-2-hydroxybenzaldehyde (I), m. 60°, very volatile with steam, has an odor of walnuts, gives a brown ppt. with FeCl_3 and does not reduce $\text{NH}_4\text{OH}-\text{AgNO}_3$ or Fehling soln. (Na deriv., bright yellow; Cu and Cr derivs., light and dark green, resp.; *oxime*, m. 125°; *p*-nitrophenylhydrazone, orange, m. 248°; *semicarbazone*, yellow, m. 236°); and 3.8 g. of the 2-fluoro-4-hydroxy deriv. (II), m. 171°, gives a deep port-wine color with FeCl_3 but no ppt. (the Cu and Cr derivs. are lighter green than those of I; *p*-nitrophenylhydrazone, deep red, m. 261°; *oxime*, m. 151°; *semicarbazone*, pale yellow, m. 238°; *benzoate*, pale yellow, m. 63°). Mono-

nitration of I gives the 5- NO_2 deriv., yellow, m. 120° , slowly volatile with steam (*phenylhydrazone*, pale yellow, m. 173° (decompn.)); *p*-nitrophenylhydrazone, golden yellow, m. 340° (decompn.)). 3,5-Di- NO_2 deriv., pale yellow, m. 165° (*phenylhydrazone*, deep orange, m. 221° ; *p*-nitrophenylhydrazone, brownish yellow, m. 254° (decompn.)). II yields a 5- NO_2 deriv., m. 126° (*phenylhydrazone*, bronze, m. 153° ; *p*-nitrophenylhydrazone, salmon, m. 270° (decompn.)); *semicarbazone*, pale yellow, m. 258° (decompn.); *oxime*, pale yellow, m. 132°) and a 3,5-di- NO_2 deriv., pale yellow, m. 138° (*phenylhydrazone*, brown-orange, m. 212° ; *p*-nitrophenylhydrazone, brownish yellow, m. 260° (decompn.)). *m*- $\text{FC}_6\text{H}_4\text{OH}$ (20 g.) in 120 cc. oleum (27% SO_3) on standing overnight and then warmed 2 hrs. at 100° gives a di- SO_3H deriv., which on monobromination and hydrolysis yields 3-fluoro-2-bromophenol, b_{80} 123° , does not solidify at -20° . This gives only a moderate yield of aldehydes in the Reimer-Tiemann reaction. 4-Fluoro-3-bromo-2-hydroxybenzaldehyde (III), does not solidify at -20° (*phenylhydrazone* yellow-brown, m. 138° ; *p*-nitrophenylhydrazone, orange, m. 215°). 2-Fluoro-3-bromo-4-hydroxybenzaldehyde, m. 106° , very slowly volatile with steam (*phenylhydrazone*, light brown, m. 85° ; *p*-nitrophenylhydrazone, red, m. 258° (decompn.); *oxime*, m. 148° ; *semicarbazone*, light yellow, m. 210°). III yields a 5- NO_2 deriv., pale yellow, m. 151° (*phenylhydrazone*, pale yellow, m. 193° ; *p*-nitrophenylhydrazone, lemon-yellow, m. 270° (decompn.)); the same product was obtained upon bromination of 4,5,2-F(O_2N)-(HO) $\text{C}_6\text{H}_3\text{CHO}$, 4,5,2-FBr(HO) $\text{C}_6\text{H}_3\text{CHO}$, m. 81° (*phenylhydrazone*, orange-brown, m. 166° ; *p*-nitrophenylhydrazone, brick-red, m. 242°); the 3- NO_2 deriv., pale yellow, m. 115° (*phenylhydrazone*, orange-brown, m. 215° ; *p*-nitrophenylhydrazone, brown, m. 258°). Nitration of 2,3,4-FBr(HO) $\text{C}_6\text{H}_3\text{CHO}$ gives the 5- NO_2 deriv., pale yellow, m. 111° , which is also obtained by brominating the mono- NO_2 deriv. of II. 4-Fluoro-2-methoxybenzaldehyde, from I and Me_2SO_4 , m. 53° (*p*-nitrophenylhydrazone, bright orange-red, m. 213° ; *oxime*, m. 128° ; *semicarbazone*, light yellow, m. 162°); 4-fluoro-2-methoxybenzoic acid, m. 136° ; with HI (d. 1.7) this yields the 2-HO deriv., m. 186° . 2-Fluoro-4-methoxybenzaldehyde, m. 47° (*phenylhydrazone*, light brown, m. 101° ; *p*-nitrophenylhydrazone, orange, m. 217° ; *oxime*, m. 95° ; *semicarbazone*, m. 228°); 2-fluoro-4-methoxybenzoic acid, m. 192° ; this could not be demethylated. C. J. WEST

Anhydro compounds derived from 2-nitro-3,4-dimethoxyphenylacetonitrile and certain pseudo-bases. JOHN M. GULLAND and C. J. VIRDEN. *J. Chem. Soc.* 1929, 1791-1803.—The application of the method of the synthesis of aporphine bases from $\text{o-O}_2\text{NC}_6\text{H}_4\text{Me}$ or a deriv. with a pseudo-base of the isoquinoline group to that large group which contains O atoms in positions 3 and 4 requires the condensation of suitable pseudo-bases with 2,3,4- $\text{O}_2\text{N}(\text{MeO})_2\text{C}_6\text{H}_2\text{Me}$; however, this condensation does not appear to take place, because the activation by the NO_2 group in position 2 is insufficient. Attention was then directed to the use of 2,3,4- $\text{O}_2\text{N}(\text{MeO})_2\text{C}_6\text{H}_2\text{CH}_2\text{CN}$ (I), which was successful. *m*- $\text{MeOC}_6\text{H}_4\text{CHO}$ and MeNO_2 condense with MeONa to give ω -nitro-3-methoxystyrene (II) (after dehydration with ZnCl_2 and AcOH), yellow, m. $91-2^\circ$; this also results by allowing a mixt. of *m*- $\text{MeOC}_6\text{H}_4\text{CHO}$, MeNO_2 , MeNH_2 , HCl and Na_2CO_3 in abs. EtOH to stand 48 hrs. at room temp. Reduction of II with Zn and dil. AcOH gives 11% of 3-methoxyphenylacetaldoxime, m. 91° ; because of the poor yield, this method was abandoned. Formyl- β -3-methoxyphenylethylamine, by heating the amine with HCO_2H 6 hrs. at 175° , b_{17} 216° ; POCl_3 gives 6-methoxy-3,4-dihydroisoquinoline, b_{16} 155° , whose methiodide (III), bright yellow, m. 199° (decompn.); III forms two periodides, $\text{C}_{10}\text{H}_{11}\text{ON}_2\text{I}_2$ and $\text{C}_{10}\text{H}_{11}\text{ON}_2\text{I}_4$, chocolate-brown, m. 82° (decompn.). Addn. of 50% KOH to III in H_2O gives 1-hydroxy-6-methoxy-2-methyltetrahydroisoquinoline (IV), m. 102° . Reduction of III in concd HCl with Zn gives 6-methoxy-2-methyltetrahydroisoquinoline, whose *HI* salt m. $173-4^\circ$; *picrate*, yellow, m. $130-1^\circ$. III, converted into the methochloride and oxidized with alk. KMnO_4 gives 1-keto-6-methoxy-2-methyltetrahydroisoquinoline, m. 50° . I and cotarnine, warmed in EtOH , give anhydrotarnine-2-nitro-3,4-dimethoxyphenylacetonitrile, cream, m. 153° (decompn.); anhydrolaudanine deriv., pale yellow, m. $125-7^\circ$. I and IV give 1- α -cyano-2'-nitro-3',4'-dimethoxybenzyl-6-methoxy-2-methyltetrahydroisoquinoline (V), yellow, m. $125-7^\circ$. These 3 anhydro compds. are readily hydrolyzed by warm. dil. acids. Reduction of V with $\text{Fe}(\text{OH})_2$ in NH_4OH gives 2-amino-3,4-dimethoxyphenylacetonitrile, m. 107° , also obtained by reducing I; *Ac* deriv., m. 184° . Formyl- β -phenylethyl-methylamine, b_{30} 183.5° ; a pseudo-base could not be obtained with SOCl_2 . The remainder of the paper deals with recent results of Avenarius and Pschorr (*Ber.* 62, 321 (1929)), who claim to have obtained apomorphine di-Me ether from I and isoquinoline-MeI (VI) or 1-hydroxy-2-methyltetrahydroisoquinoline. Solns. of I and VI in equimol. proportions were boiled gently for a short time and then kept at room temp. for periods ranging from 24 to 60 hrs. Although the subsequent treatment of these solns.

was greatly varied, the only product isolated was 2-methyltetrahydroisoquinoline-MeI, m. 192°. A by-product of I is 2-nitro 3,4-dimethoxyphenylacetamide, m. 151-3°.

C. J. WEST

† The tolyl esters of phenylacetic acid. L. CHAS. RAIFORD AND J. G. HILDEBRAND, JR. *Am. J. Pharm.* **101**, 481-4 (1929).—A method of prepn. and analyses for the isomeric tolyl esters of $\text{PhCH}_2\text{CO}_2\text{H}$ are given. Phenylacetyl chloride was prepd. by the interaction of SOCl_2 and $\text{PhCH}_2\text{CO}_2\text{H}$, using a modification of the general method of Meyer (*Sitz. kais. Akad. Wiss.* **110**, Abt. II, 318 (1901)). A drawing of the app. used is shown. The reaction mixt. was placed in flask A, which is provided with a thermometer to indicate the reaction temp. The vertical arm of the connecting tube is tall enough to prevent SOCl_2 from passing over during the reaction, and carries at the top a thermometer for use in distn. One part by wt. of $\text{PhCH}_2\text{CO}_2\text{H}$ and 1.5 to 2 parts of SOCl_2 were placed in flask A, the flask attached to the connecting tube, and the mixt. heated at 90° to 100° for 31 rs. The excess of SOCl_2 was then distd. off under atm. pressure and the residue fractionated under reduced pressure. PhCH_2COCl b₁₆ 100-1° as a colorless, heavy liquid. Yield, 92%. *p*-Tolyl phenylacetate was prepd. by heating a mixt. of 11 g. of freshly distd. *p*-cresol and 16 g. of PhCH_2COCl at about 90° in a small, wide-mouth flask until the evolution of HCl ceased, cooling the mixt. and pouring with rapid stirring into 200 cc. of previously chilled 6 N NaOH. After some time the solid was filtered off and washed. Yield, 83%. Three crystns. from alc. gave colorless masses of small blocks, m. 74.5°. The product was identified by hydrolysis, isolation and recognition of the corresponding phenol and acid. *m*-Tolyl ester, prepd. in 72% yield by the method described, was obtained in colorless thick irregular plates by repeated crystn. as follows: the hot alc. soln. in a small filter flask was dild. with enough H_2O so that at about 40° it became turbid. The mouth of the flask was then closed with a 1-hole stopper bearing a narrow glass tube, the lower end of which was 2.5-3 cm. above the surface of the liquid, the temp. raised to about 45° and held there, while slow evapn. was brought about by gentle suction through the side neck of the flask. Colorless, irregular plates were obtained, m. 51.2°. *o*-Tolyl ester was obtained in 82% yield as above indicated. Two crystns. from alc. as described gave colorless plates, m. 44-5°. The product was identified by hydrolysis.

W. G. GAESSLER

The preparation and structure of bromo-*m*-hydroxybenzoic acid (CO_2H , OH, Br 1,3,2). P. H. BEYER. *Re. trav. chim.* **48**, 1010-1 (1929).—2,3-Br(HO) $\text{C}_6\text{H}_3\text{CO}_2\text{H}$ was prepd. as follows: *m*-AcNH $\text{C}_6\text{H}_4\text{CO}_2\text{H}$ was nitrated according to the method of Kaiser (*Ber.* **18**, 2943 (1885)), the 2 nitro compds. being sepd. by means of the Ba salts. On boiling with KOH, the 2-nitro acid was converted into 3,2-HO(O₂N) $\text{C}_6\text{H}_3\text{CO}_2\text{H}$, which was reduced to the 2-amino acid with Na_2S . On applying the Sandmeyer method to the latter compd., 2-bromo-3-hydroxybenzoic acid was obtained, m. 160-1°. The structure of it is compd. follows from its prepn.

C. F. VAN DUIN

Acetylene oxides and α -lactones. W. MADELUNG AND M. E. OBERWEGNER. *Naturwissenschaften* **17**, 430 (1929).—Unsatur. ring systems of less than 5 components including one O atom are named acetylene oxides, the mono- and di Ph compds. were prepd. also with addnl. HO and alkoxy groups. The latter represent enol forms of the α -lactones of mandelic acid. The prepn. was made from halogenated ketones or from $\text{PhCHClCO}_2\text{H}$.

B. J. C. VAN DER HOEVEN

The condensation of pinonic acid with aldehydes. O. FERNANDEZ AND G. DE MIRASIERRA. *Rec. trav. chim.* **48**, 852-4 (1929).—Neither phenols nor aldehydes condense with pinonic acid but phenolic aldehydes do and the presence of both the phenolic OH group and the aldehyde group is essential for this condensation. The reaction takes place only when HCl or H_2SO_4 is used as condensing agent. From pinonic acid (3 g.), salicylic aldehyde (2 g.), 49 cc. EtOH and 20 cc. concd. H_2SO_4 , the condensation product *o*-HO $\text{C}_6\text{H}_4\text{CH}(\text{CHCOCH}(\text{CH}_2\text{CH}(\text{CH}_2\text{CO}_2\text{H}))\text{CMe}_2$ (I) is obtained after 3

days at room temp. as a red powder, m. 153-51°, which could not be recrystd. The Et ester of pinonic acid gives the Et ester of I while vanillin gives rise to the formation of a blue powder having a constitution analogous to I, m. 240°. C. F. VAN DUIN

The reactions and space formula of biphenyl. E. E. TURNER. *Rec. trav. chim.* **48**, 821-5 (1929).—The independence of the 2 nuclei in Ph_2 is demonstrated by the fact that on reduction according to Sabatier and Senderens phenylcyclohexane may be obtained while on reduction with Na and AmOH (Bamberger and Lodter, *Ber.* **20**, 3077 (1887)) a phenylcyclohexene is formed. Benzene is to be considered nowadays as a delicately balanced equil. mixt. of a large no. of mobile forms (Kekulé, Dewar, Armstrong-Bayer) in which one of the forms appears to be stabilized by the introduction of a substituent and a similar condition of affairs exists with Ph_2 . There is,

fication. Refluxing 2 hrs. completed the reaction. This substance was nitrated by the Eckert and Langecker method (*C. A.* 22, 1969) to 3-nitro-2-methoxyfluorene, 3 g. of the latter dissolved in 150 cc. of boiling alc., 5 g. of Sn filings added gradually while adding 50 cc. of HCl (d. 1.19), then refluxing until colorless, allowing to stand overnight to sep. the HCl salt, filtering and decomg. with Na_2CO_3 , gave 2.3 g. of needles, m. 187° . Two g. of 3-amino-2-methoxyfluorene was dissolved hot in 10 cc. distd. H_2O and 3 cc. of concd. HCl, cooled to 0° , and a soln. of 1 g. KNO_2 in 5 cc. H_2O added, giving a yellow soln. of diazonium-2-methoxy-3-fluorene, which was poured gradually into 500 cc. of boiling H_2O contg. 3 cc. of concd. H_2SO_4 , cooled and washed with H_2O , giving 3-hydroxy-2-methoxyfluorene (fluoreneguaiacol) (yield 1.5 g.), m. 185° , slightly sol. in cold, more sol. in hot H_2O , sol. in most org. solvents. Treated with $\text{Br-H}_2\text{O}$ and *p*-aminophenol, or with *p*- $\text{C}_6\text{H}_4(\text{NH}_2)_2$ it gives no color. One cg. of fluoreneguaiacol mixed with an equal amt. of $\text{C}_6\text{H}_5(\text{CO})_2\text{O}$ and 0.2 g. ZnCl_2 , fused, 2 cc. water and a little 10% NaOH, gives no color. Treating a 50% alc. soln. with FeCl_3 gives a red-violet color and a fluorescent ppt. Heating destroys the color, forming a red ppt. FeCl_3 gives no color. A few cg. of fluoreneguaiacol in dil. NaOH soln., to which is added 3-4 drops of a 5% NaNO_2 acidified by AcOH gives a yellow ppt. of the nitroso deriv., dissolving in alkalis with a red color. Treating fluoreneguaiacol in dil. NaOH soln. with a soln. of diazobenzene-*p*-sulfonic acid gives an intense red-violet color. Treating 2 g. of 3-nitro-2-methoxyfluorene with 100 cc. of 10% NH_4OH and heating to 150° for 8 hrs. gives a red color and red ppt.

E. M. SYMMES

Existence and stability of free radicals. HAROLD BURTON AND CHRISTOPHER K. INGOLD. *Proc. Leeds Phil. Lit. Soc., Sci. Sect.* 1, Pt. 9, 421-31.—The paper is a theoretical discussion of the authors' theory regarding triarylmethyl and analogous free radicals as previously stated, "The power of the Ph group . . . to compensate electrostatic disturbances of either sign in an attached atom is doubtless the cause of the dissociability of the hexa-aryl ethanes and allied compds." Numerous illustrations from the literature are given in support of the theory suggested. The "affinity-demand" theory of Flürscheim for the stability of free radicals is vigorously attacked. It is claimed that aryl groups may activate both anionotropic and prototropic systems, and that they "confer on the attached atom the power of tolerating an elec. charge of either sign." It is suggested that the principal mechanism by which this is brought about consists in the displacement of the electrons of the aromatic sextet, dependent on the sign of the charge and upon the principle of the preservation of the aromatic octets. The theory of "complex-sharing" of electrons is upheld by the authors. Polymerization of ketyls, anils and analogous compds. is discussed from the viewpoint of preliminary free-radical formation.

J. B. ENRIKIN

Optically active diazo compounds. IV. A stable alicyclic diazo amine. CHESTER W. BENNETT AND WM. A. NOYES. *Rec. trav. chim.* 48, 895-8 (1929).—Previous investigations in the field of the optically active diazo compds (Chiles and Noyes, *C. A.* 16, 3466; Kendall and Noyes, *C. A.* 20, 3165) have been criticized on the grounds that the optical activity may be due to impurities which it is impossible to remove from such unstable compds. or, as with Me γ -diazocamphonanate, that it is the 2nd asym. C atom which is the cause of the optical activity. 2-Amino-diazo-9-diazofluorene was now prepd. as follows: 2-nitrofluorene was prepared by nitration of technical fluorene in AcOH (cf. Diels, *Ber.* 34, 1764 (1901)) and oxidized to 2-nitrofluorenone by means of Na dichromate in AcOH (cf. Diels, *l. c.*). On reduction with alc. $(\text{NH}_4)_2\text{S}$ the nitro compd. was converted into the amine, which, on treatment with N_2H_4 (Gerhardt, *C. A.* 14, 3409) yields 2-amino-9-fluorenonehydrazone, orange needles, m. 209° . A suspension of this hydrazone in 95% alc., contg. a minute amt. of NaOEt, was oxidized with Hg acetamide (Forster, *J. Chem. Soc.* 73, 783 (1898)) to 2-amino-9-diazofluorene, small reddish orange needles, m. 137° . This compd., however, could not be resolved into its optical isomers by means of *d*-camphorsulfonic acid and, on boiling with dil. HCl, passes into 2-amino-9-fluoreneol, m. 194.5° .

C. F. VAN DUIN

The action of sulfur dioxide on the halomagnesiyl derivatives of the carbinols. WILHELM SCHMIDT-NICKELS. *Ber.* 62B, 917-9 (1929).—The bromomagnesiyl deriv. of Ph_3COH obtained from Ph_3CO and PhMgBr absorbs SO_2 to form $\text{Ph}_3\text{COSO}_2\text{MgBr}$ (I) which decomps. with H_2O into MgBr_2 and cryst. $(\text{Ph}_3\text{COSO}_2)_2\text{Mg}$ (II), insol. in H_2O . II and H_2SO_4 give the Ph_3COH (III) color reaction. II heated at 180° liberates SO_2 to form a Mg compd. which gives III by treatment with H_2SO_4 . The bromomagnesiyl deriv. of 9-phenyl-9-fluoreneol and SO_2 give $[(\text{C}_6\text{H}_5)_3\text{CPhOSO}_2]_2\text{Mg}$ (IV), which is more stable than II, and decomps. only at 320° , with elimination of SO_2 . The iodomagnesiyl deriv. of MePh_2COH and SO_2 give $\text{MePh}_2\text{COSO}_2\text{MgI}$ (V). V with H_2O gives $\text{MePh}_2\text{CCH:CPh}_2$, and BrMgSO_3H .

ALBERT L. HENNE

Alkali organic compounds. I. Reaction between unsaturated hydrocarbons and alkali metal alkyls. K. ZIEGLER, F. CRÖSSMANN, H. KLEINER AND O. SCHÄFER. *Ann.* 473, 1-35(1929); cf. *C. A.* 22, 1769.—Directions are given for the prepn of PhCKMe₂ (I); the content of reagent can be detd. by adding BuBr and titrating the liberated Br. The reaction products of I with unsatd. hydrocarbons were transformed into acids by the action of CO₂ and usually analyzed as the Ag salt. Ph₂C:CHPh does not react with I. (C₆H₅)₂C:CHPh gives 85% of fluorencarboxylic acid, m. 205-6° (decompn.). PhCH:CHMe gives 64% of the acid, PhCH(CO₂H)CHMeCMe₂Ph, m. 146-7°. PhCMe:CH₂ gives 90% of the acid, PhC(CO₂H)MeCH₂CMe₂Ph, oily. PhCH:CMe₂ gives 82% of the acid, PhCH:CMeCH₂CO₂H, m. 80-1°; the reduction product, PhCH₂CHMeCH₂CO₂H, is liquid. Ph₂C:CHMe gives 74% of the acid, Ph₂C:CHCH₂CO₂H, m. 112-3°; reduction gives the known Ph₂CHCH₂CH₂CO₂H, m. 104°. Ph₂C:-CMe₂ gives a mixt. of *β*-diphenylmethyleneglutaric acid, m. 153-4°, and *γ,γ*-diphenyl-*β*-methylvinylacetic acid, m. 108°. Ph₂C:CHEt gives 91% of the acid, Ph₂C:CHCH(CO₂H)Me, liquid. Ph₂C:CHCH₂Ph gives 62% of phenyl-*β,β*-diphenylvinylacetic acid, m. 166-7°, also obtained by the reaction of Ph₂C:CHCH(OMe)Ph with K-Na and then with CO₂; the reduction product, *α,α,γ,γ*-triphenylbutyric acid, m. 111-2°. *α,α,γ*-Triphenylbutyric acid, m. 181°. PhMeC:CHPh gives 78% of PhC(CH₂CO₂H):-CHPh, m. 168°. (C₆H₅)₂C:CHMe gives 73% of the acid, (C₆H₅)₂C(CO₂H)CHMeCMe₂Ph, m. 113°. PhCH:CH(CH₂)₂Ph, m. 42-2.5°, is easily obtained by warming the isomer, (PhCH₂CH)₂, with 5% AmONa 3 hrs.; it adds I, giving the acid PhCH(CO₂H)-CH(CH₂CMe₂Ph)CH₂CH₂Ph, which crystd. after long standing. (PhCH₂CH)₂ gives a monosubstitution product, 1,4-diphenyl-2-butene-1-carboxylic acid, thick brown resin (70% yield); with 1/3 of a mol. of hydrocarbon there results the disubstitution product, 1,4-diphenyl-2-butene-1,4-dicarboxylic acid, m. 233-4°. The acid, C₂₀H₂₆O₂, from (PhCH₂CH)₂ was obtained only as a thick resin. (PhCH₂CH:CH)₂ gives 78% of 1,6-diphenylhexa-2,4-diene-1,6-dicarboxylic acid, m. 240-2°. Detailed directions are given for the production of *Li* alkyls. These solns. may be analyzed by adding BuBr and then (PhCH₂)₂Hg; LiCH₂Ph is formed which then reacts with the BuBr. In C₆H₆ Ph₂C:CH₂ and LiBu give *α,α*-diphenylheptylic acid, m. 104-5°, which was synthesized as follows: C₆H₁₁CO₂Et and 3 mols. PhMgBr give *α,α*-diphenylhexyl alc., m. 46.5-7.5°; the *Me* ether, m. 58°, with K-Na and CO₂ gives the above acid. The kinetics of the addn. of LiEt, LiPr and LiBu to Ph₂C:CH₂ are reported; the values for *K* are 1.5-1.6, 3.4 and 2.8, resp. LiBu in Et₂O is stable for 3-4 hrs., after which the amt. of free alkali increases. LiBu and Ph₂C:CH₂ react completely in Et₂O in 10 min. (PhCH)₂ and LiBu in Et₂O give *α,β*-diphenylheptylic acid, m. 102°. **II. Study of Schlenk's addition of alkali metals to unsaturated hydrocarbons.** K. ZIEGLER, H. COLONIUS AND O. SCHÄFER. *Ibid* 36-56.—The original should be consulted for the theoretical discussion of the work of Schlenk (*C. A.* 8, 1580; 22, 4493). In concd. soln., 5 g. Ph₂C:CMe₂, 5 g. K + 1 g. Na and 100 cc. Et₂O, there results after treatment with CO₂ *α,α*-diphenylisovaleric acid, m. 168-9°. This acid is also obtained from the *Me* ether of Ph₂C(OH)CHMe₂, b_{0.5} 125°, and K-Na followed by the action of CO₂. In dil. soln., 2.3 g. Ph₂C:CMe₂ and 2 g. K in 450 cc. Et₂O, there results in addn. to the above acid, *γ,γ*-diphenyl-*β*-methylvinylacetic acid, m. 108°; the *thioamides* of the 2 acids m. 161° and 144-5°, resp. The action of Na in liquid NH₃ upon Ph₂C:-CH₂ in PhMe gives a product which, decompd. with NH₄Cl, gives Ph₂CHCH₂, b₁₀ 150°. If PhCH₂Cl is used in place of NH₄Cl there results Ph₂C(CH₂Ph)Me, m. 113°. If the Na is carefully added in small portions to the mixt. of NH₃, PhMe and Ph₂C:CH₂ there results (Ph₂CHCH₂)₂. Na in liquid NH₃ reacts with Ph₂C:CHCH₂Ph in PhMe to give Ph₂CHCH₂CH₂Ph. **III. Polymerization of unsaturated hydrocarbons under the influence of alkali metals and alkali metal alkyls.** K. ZIEGLER AND H. KLEINER. *Ibid* 57-82.—PhCKMe₂ causes the polymerization of (CH₂:CH)₂; the following figures give the no. of mols. of (CH₂:CH)₂ used with 1 mol. PhCKMe₂, the equiv. of the acid formed, and the no. of double bonds per equiv.: 0, 164, 0; 2, 218, 1.32; 3, 268, 2.20; 4, 302, 2.77; 5, 363, 3.77; 7, 417, 4.30; 10, 477, 5.55; 8, 493, 6.04. The possible reactions are discussed and formulas given for the products.

C. J. WEST

Production of pinacols in the reaction between a carboxylic ester and a Grignard reagent. HAROLD H. HATT. *J. Chem. Soc.* 1929, 1623-32.—A carboxylic ester and the Grignard reagent in the presence of Mg yield a pinacol (Boyd and Hatt, *C. A.* 21, 2266). In order to improve the yield the reaction was carried out with Mg and MgI₂, but this led to unexpected results. BzOMe and PhMgBr at 30-60° in the presence of sufficient Mg and MgI₂ to give a theoretical yield of (IMgOCR₂)₂, no benzo-pinacol could be isolated; when the PhMgBr was added rapidly to the ester, the strong

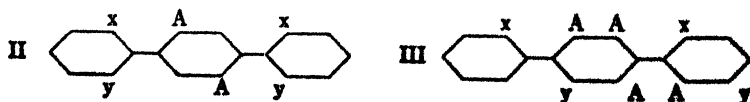
purple color of the metal ketyl appeared for a while but vanished as soon as the addn. was complete. $o\text{-ClC}_6\text{H}_4\text{CO}_2\text{Et}$ and PhMgBr with Mg and a little MgI_2 gave 27% of the corresponding pinacol but when the theoretical amt. of Mg and MgI_2 was used, the yield fell to 5%. Similarly the yield from $o\text{-MeC}_6\text{H}_4\text{CO}_2\text{Et}$ and PhMgBr fell from 45 to 10%. Adding 0.2 g.-mol. of the RMgX during 1.75–2 hrs. to 0.1 g.-mol. of the ester in Et_2O at 50° in the presence of 0.1 g.-atom of Mg in a N atm. gave the following yields (% of pinacol and % of carbinol calcd. from 0.1 mol. of ester): PhMgBr with BzOMe , 2, 44; with $o\text{-MeC}_6\text{H}_4\text{CO}_2\text{Et}$, 40, 23; with $p\text{-MeC}_6\text{H}_4\text{CO}_2\text{Et}$, 3, 37; with $o\text{-ClC}_6\text{H}_4\text{CO}_2\text{Et}$, 27, 31; with $o\text{-BrC}_6\text{H}_4\text{CO}_2\text{Et}$, 9, 5; with $o\text{-MeOC}_6\text{H}_4\text{CO}_2\text{Me}$, 0, 52; with $\alpha\text{-C}_{10}\text{H}_7\text{CO}_2\text{Et}$, 4, 22; $p\text{-MeC}_6\text{H}_4\text{MgBr}$ and $o\text{-MeC}_6\text{H}_4\text{CO}_2\text{Et}$, 52, 6; $o\text{-MeC}_6\text{H}_4\text{MgBr}$ and $o\text{-MeC}_6\text{H}_4\text{CO}_2\text{Et}$, 0, —; with $o\text{-ClC}_6\text{H}_4\text{CO}_2\text{Et}$, 0, —. *sym*-2,2'-Dichlorobenopinacol, m. 164° (decompn.), results from PhMgBr and $o\text{-ClC}_6\text{H}_4\text{CO}_2\text{Et}$ and also by the reduction of $o\text{-ClC}_6\text{H}_4\text{Bz}$; a 2nd form, m. 181° , results in both cases and is sepd. by crystn. from CHCl_3 and EtOH ; the higher-melting form has been previously reported; with PhMgBr the higher-melting form gives chiefly the lower-melting form. The action of HCl upon the reaction product of $p\text{-MeC}_6\text{H}_4\text{MgBr}$ and $o\text{-MeC}_6\text{H}_4\text{CO}_2\text{Et}$ gives *di*-*p*-tolyl-*o*-tolylchloromethane, m. 106° . $p\text{-MeC}_6\text{H}_4\text{MgBr}$ and $o\text{-MeC}_6\text{H}_4\text{CO}_2\text{Et}$ give principally *di*-*p*-tolyl-*di*-*o*-tolylpinacol, m. 174° (decompn.); reduction with Zn and alc. KOH gives *p*-tolyl-*o*-tolylcarbinol, m. $61\text{--}1.5^\circ$. Rearrangement of diphenyl-*di*-*o*-tolylpinacol gives *o*-tolyl-*di*-phenyl-*o*-tolylmethane, crystg. with 1 EtOH and m. $93.5\text{--}4.5^\circ$ and crystg. without EtOH , m. 129° .

C. J. WEST

The influence of certain solvents in the preparation of cyclic thioureas. ESTHER MARANGONI AND MARIA J. LAMORT. *Rev. Farm.* (Buenos Aires) [2], 2, 332–9 (1929).—The action of $\alpha\text{-C}_{10}\text{H}_7\text{NH}_2$ on CS_2 was studied without a catalyst and in the presence of S or Et xanthogenate. Petroleum ether as a solvent prevents the reaction. PhMe gives good results with xanthogenate, tetralin is active, but with S a red sol. compd. is formed and no traces of thiourea. Decalin gives with S a green ppt. PhCOMe and PhCO give no results, while MeCOEt and Me_2CO give the best results. Et_2O is poor, Am_2O and iso-AmOAc give an av. yield. Heat is injurious. It is supposed that the presence of a double linkage, that acts in 2 tautomeric ways, is favorable to the reaction.

A. E. MEYER

Stereochemistry of biphenyl compounds. III. The resolution of 2,2'-dihydroxy-3,3'-dicarboxy-1,1'-binaphthyl. W. M. STANLEY AND ROGER ADAMS. *Rec. trav. chim.* 48, 1035–40 (1929); cf. *C. A.* 22, 3886–7; 23, 1406.—The most satisfactory explanation of the optical isomerism in the Ph_2 series is that such rings are not coplanar, due to the fact that the 2,6,2',6'-groups interfere with each other to prevent the free rotation. It is thus of interest to prep. 2,6,2',6'-substituted products with groups of as small at. or mol. vol. as possible. Among such groups is the OH group and therefore 2,2'-dihydroxy-3,3'-dicarboxy-1,1'-binaphthyl (I) was synthesized from 2,3- $\text{C}_{10}\text{H}_6(\text{OH})(\text{CO}_2\text{H})$ by oxidizing 7 g. in 7 l. of boiling water with 7 g. of crystd. FeCl_3 ; it forms light yellow needles, m. $331\text{--}3^\circ$ (all m. ps. cor.); yield 75%. On using the Na salt of the $\text{C}_{10}\text{H}_6(\text{OH})(\text{CO}_2\text{H})$, much smaller vols. of H_2O may be used and the yield is increased; the crude product has, however, to be recrystd. from 80% AcOH although crystn. from EtOH decreases the loss. The *di*-*Et* ester of I, prepd. in the usual way, m. $230\text{--}2^\circ$. The acid I could be resolved easily by means of its *di*-brucine salt, m. $244\text{--}6^\circ$; $[\alpha]_D^{20} -85^\circ$; the acid itself, obtained from the dibrucine salt in the usual way, m. $326\text{--}9^\circ$, $[\alpha]_D^{20} -171.9^\circ$. Fractional crystn. of the dibrucine salt from the mother liquors gave the salt of the *d*-acid; the *d*-acid itself m. $326\text{--}9^\circ$, $[\alpha]_D^{20} 171.0^\circ$. Esterification of the *l*-acid produced the *di*-*Et* ester, m. $218\text{--}20^\circ$; $[\alpha]_D^{20} -134.0^\circ$. I shows a great optical stability, no racemization occurring by boiling its soln. in AcOH , a slight racemization on boiling the soln. in a mixt. of equal vols. EtOH and concd. HCl and a somewhat larger racemization on boiling the soln. in 16% KOH . Finally, the possible isomerism of the compds. of type II and III are discussed: a compd. of type II should be capable of existing in a *dl*- and a *meso*-modification; if the 2 groups in one of the end rings are x' and y' instead of x and y , there should be 2 *dl*-modifications and no *meso*-form. In type III, however, 2 isomers of the *cis-trans*-type should exist, neither of which is resolvable.



C. F. VAN DUIN

Obtaining anthracene and carbazole. J. ALTPETER. *Metallbörse* 19, 1686-8 (1929).—A review of patents.

Synthesis of meso-alkyl- and meso-arylanthracene derivatives. VI. EDWARD DE B. BARNETT AND NORMAN F. GOODWAY. *J. Chem. Soc.* 1929, 1754-61; cf. *C. A.* 23, 2172.—Addn. of 9-benzohydrylanthrone (I) to 3 mols. MeMgI gives 10-benzohydryl-9-methyl-9,10-dihydroanthran-9-ol (II), m. 216°, which, heated with AcOH-HCl 1 hr. at 100°, gives 10-benzohydryl-9-methylantracene, colorless with strong violet fluorescence. I and PhCH₂MgCl give the 9-benzyl deriv. (corresponding to II), m. 181°, giving with AcOH-HCl, 10-benzohydryl-9-benzylantracene, m. 236°. I and PhMgBr give the 9-Ph deriv., m. 222°, which gives with acid a fluorescent product which could not be crystd. 2-Methyl-9-anthrone (III) with C₆H₅N-Ac₂O gives 2-methyl-9-anthranyl acetate, pale yellow, m. 143°, and with p-McC₆H₄SO₂Me, 2-methyl-9-anthranyl Me ether, m. 77°. III (11 g.) and 3 mols. MeMgI give 3 g. 2,9-dimethylantracene, yellow, m. 85°; the poor yield was due to the enolizing action of the MeMgI but the use of 2 or 5 mols. failed to improve it. Br in CS₂ gives 9-bromomethyl-2-methylantracene (IV), deep yellow, m. 150° (decompn.); further action of Br gives the 10-Br deriv. (V), yellow, m. 190°. III (11 g.) and PhCH₂MgCl give 9 g. 9-benzyl-2-methylantracene, m. 139°; Br in CS₂ gives the 10-Br deriv., bright yellow, m. 164°. IV and piperidine in CHCl₃ give 9-piperidinomethyl-2-methylantracene, m. 128°; V gives the 10-Br deriv., pale yellow, m. 167°. IV and PhNH₂ give 9-anilinomethyl-2-methylantracene, pale yellow, m. 164°; V gives the 10-Br deriv., pale yellow, m. 144°. Reduction of 2-methylantraquinone with Al powder and concd. H₂SO₄ gives 3-methyl-9-anthrone (VI), pale yellow, m. 101°, isolated through 3-methyl-9-anthranyl acetate, m. 139°. VI and MeMgI give 3,9-dimethylantracene, m. 85°; Br gives an impure 9-bromomethyl deriv., m. 145°, giving with more Br 10-bromo-9-bromomethyl-3-methylantracene, yellow, m. 186°; piperidine converts this into the 9-piperidinomethyl deriv., yellow, m. 140°. VI and PhCH₂MgCl give 9-benzyl-3-methylantracene, m. 101°; 10-Br deriv., pale yellow, m. 139°.

C. J. WEST

Chemistry of perylene. FREDERICK A. MASON. *Ind. Chemist* 5, 137-40 (1929); cf. *C. A.* 23, 2436.—A review with reference to the use of perylene as an intermediate for the production of important vat dyes. Bibliography.

A. S. CARTER

2-Ethylpyrrole. (MISS) M. E. A. DE JONG. *Rec. trav. chim.* 48, 1029-30 (1929).—Several papers deal with a C-ethylpyrrole, leaving, however, doubt about the question whether a 2- or 3-ethylpyrrole is dealt with: Dennstedt and Zimmermann (Ber. 19, 2190 (1886)) obtained an oil from pyrrole, paraldehyde and ZnCl₂, which they considered to be 3-ethylpyrrole; Oddo and Mameli (*C. A.* 9, 788) obtained 3-ethylpyrrole from C₄H₅NMgBr and EtBr, but Hess, Wissing and Suchier (*C. A.* 10, 465) considered this compd. to be the 2-deriv., while Zanetti (*Gazz. chim. ital.* 19, 91 (1889); Ber. 22, 659 (1889)) considered the reaction product from K pyrrole and EtI and Dennstedt that from pyrrole, EtOH and Zn powder to be the 3-isomer (Ber. 23, 2563 (1890)). 2-Ethylpyrrole was prepd. from 2-acetylpyrrole (Oddo, *C. A.* 4, 2460) by heating with Na, abs. EtOH and N₂H₄ at 180°, an oil, b. 160-70°, being obtained; this product was identical with the products obtained from pyrrole, paraldehyde and ZnCl₂ (D., l. c.) and from C₄H₅NMgBr and EtBr (O. and M., l. c.). On boiling 2-acetylpyrrole with alc. N₂H₄, acetylpyrrole ketazine, m. 212-3°, is obtained, while the semicarbazone, prepd. in the usual way, m. 190°; both compds. on heating with Na in abs. EtOH at 180° yield 2-ethylpyrrole. All these methods only give small yields and the best way to prep. 2-ethylpyrrole, b. 163-5°, is the isomerization of N-ethylpyrrole at 650°.

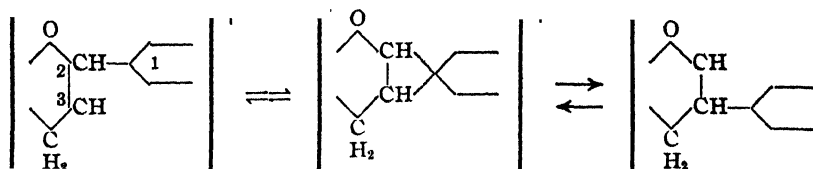
C. F. VAN DUIN

Synthesis of some phenyl styryl ketones and related compounds. NICHOLAS M. CULLINAN AND DAVID PHILPOTT. *J. Chem. Soc.* 1929, 1761-5.—1,4,6-HO(MeO)₂-C₆H₃Ac (4 g.) and 3.6 g. 2,4-(MeO)₂-C₆H₃CHO, condensed with KOH, give 4 g. 2-hydroxy-4,6-dimethoxyphenyl 2,4-dimethoxystyryl ketone, yellow, m. 128°; concd. H₂SO₄ gives a deep red soln., Br in CHCl₃ in a freezing soln. gives 3,5,2',4'-tetramethoxy-4-bromobenzylidenecoumaran-2-one, bright yellow, does not m. at 300°; the concd. H₂SO₄ soln. is purplish red. 2,4,6-(MeO)₃-C₆H₂Ac and o-HOC₆H₄CHO condense with KOH to give 2,4,6-trimethoxyphenyl 2-hydroxystyryl ketone, yellow, m. 205.5° (decompn.); H₂SO₄ gives an orange, NaOH a bright yellow soln. With HCl in AcOH this yields 2',4',6'-trimethoxyflavylium chloride, red, m. 162°, giving an orange soln. in concd. H₂SO₄; ferrichloride, reddish brown, m. 198°.

C. J. WEST

Intramolecular rearrangement in optically active systems. KARL FREUDENBERG. *Heidelberger Ber.* 1927, No. 10, 13 pp.; *Physik. Ber.* 9, 454-5.—During the transformation of optically active tetramethyl-d-catechol into the corresponding chloride, a re-

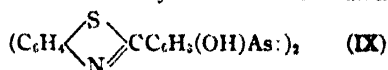
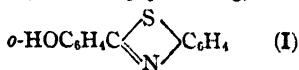
arrangement takes place, which can be represented as follows (the non-essential parts of the mol. have been omitted in the diagram):



F. discusses the possible structure of the intermediary step, and the nature of the bonds represented by the dotted lines.

ALBERT L. HENNE

Thiazoles. XV. Benzothiazole arsenicals of arsphenamine (salvarsan) type. MARSTON T. BOGERT AND FREDERICK G. HESS. *Rec. trav. chim.* **48**, 904-11(1929); cf. *C. A.* **20**, 1236; **22**, 423.—This research was undertaken with the view to preparing tervalent arsenicals of the salvarsan type in the benzothiazole series. 2-[2'-hydroxyphenyl]benzothiazole, m. 131.7-2.2° (I), was synthesized from Zn *o*-aminothiophenolate and *o*-HOC₆H₄CHO (Bogert and Corbitt, *C. A.* **20**, 1236); on treatment with alkali this compd. is converted into benzoysalicylic acid. The same synthesis with 5-nitrosalicylaldehyde (cf. von Miller, *Ber.* **20**, 1930(1887)) yields 2-[2'-hydroxy-5'-nitrophenyl]benzothiazole (II), m. 219.1-9.6° (all m. ps. are cor.), which, on reduction with Na₂S₂O₄ yields 2-[2'-hydroxy-5'-aminophenyl]benzothiazole (III), m. 190-0.5°. This amine was also obtained by coupling PhN₂Cl with I in alk. soln., when the azo dye produced sepd. immediately as an orange-yellow ppt. which was reduced by Na₂S₂O₄. An attempt to convert this amino compd. into the 5'-Cl compd. resulted in the formation of I; *di-Ac* deriv. of III, m. 268-8.5°. The condensation of Zn *o*-aminothiophenolate with resorcyaldehyde yields 2-[2',4'-dihydroxyphenyl]benzothiazole (IV), m. 201-1.5°; *di-Ac* deriv. of IV, m. 196.1-6.6° (cor.). On coupling IV with PhN₂Cl and reducing the azo dye thus produced, a dihydroxy amino compd. was obtained, which oxidized rapidly on exposure to the air and could not be analyzed. Using protocatechuic aldehyde instead of resorcylic aldehyde, 2-[3',4'-dihydroxyphenyl]benzothiazole, m. 222.3-2.8° (V) was obtained; *di-Ac* deriv., m. 155.9-6.4°. On adding 2 g. of I to 3 g. of As₂O₃, heating to 150°, and keeping the mixt. for 6 hrs. at 150-60°, 2-[2'-hydroxyphenyl]benzothiazole-5'-arsonic acid (VI), m. 315.5°, was obtained, the structure being proved by its formation from III by means of the Bart reaction (*C. A.* **17**, 82). Nitration of VI gives a mononitro compd., probably 2-[2'-hydroxy-3'-(?)-nitrophenyl]benzothiazole-5'-arsonic acid (VIII), m. 297.7-8.7°. On fusing IV with As₂O₃ for 6 hrs. at 160-70°, 2-[2',4'-dihydroxyphenyl]benzothiazole-5'-(?)-arsonic acid (VIII), m. 280° (yield 20%), was obtained. The reduction of VI with alk. Na₂S₂O₄ yields 3,3'-dibenzothiazolyl-dihydroxyarsenobenzene (IX), m. 240.8-1.3°; yield 82%. NaH₂PO₂ may also be used as a reducing agent in AcOH soln., the yield being 70%. On reducing VII with SnCl₂ in a mixt. of concd. HCl and AcOH, 3,3'-dibenzothiazolyl-4,4'-dihydroxy-5,5'-(?)-diaminoarsenobenzene-di-HCl (X) was produced, while the same procedure, applied to VIII, gives 3,3'-dibenzothiazolyl-4,4',6,4',6'-tetrahydroxyarsenobenzene (XI), an exceedingly unstable compd. (cf. Bauer, *C. A.* **9**, 1778). Pharmacol. tests, carried out with I on animals, were very promising, but the compd. was too difficultly sol. for use on humans.

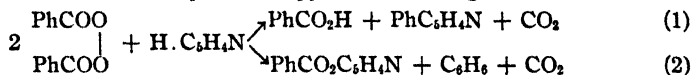


C. F. VAN DUIN

The formation of aminopyridine by the action of gaseous ammonia on pyridine in the presence of catalysts. J. P. WIBAUT AND L. M. F. VAN DE LANDE. *Rec. trav. chim.* **48**, 1005-9(1929); cf. *C. A.* **22**, 2357.—W. has already shown that gaseous NH₃ and benzene react in the presence of finely divided Ni, Fe or Cu at 520-50° with the formation of PhNH₂, the yield, however, being very small (*C. A.* **11**, 2805); Meyer has shown that this reaction takes place also without catalysts at 700° (*C. A.* **13**, 1324). It is now calcd. that the reaction between pyridine and NH₃ is a slightly endothermic one: C₅H₅N + NH₃ → C₅H₅NNH₂ + H₂ -4.4 Cal., the following thermochem. consts. being used: heat of combustion of pyridine at const. pressure 664.6 Cal.; the same const. for C₅H₅NNH₂, 685.8 Cal., both figures being detd. by Verkadé and Coops for pyridine, purified by means of the picrate (m. 167-8°), *b*₇₇₅ 114.4-5.0°, and α-C₅H₅NNH₂, recrystd. to a const. setting point 57.8°. The heat of vaporization of α-C₅H₅NNH₂ was assumed to be 10.0 Cal., the difference of the heats of vaporization

of aniline and benzene, 1.5 Cal., being added to the heat of vaporization of pyridine (8.5 Cal.), while the heat of fusion of this compd. was calcd. according to the rule of Walden (cf. Haber and Tamaru, *C. A.* 9, 2619) to be 4.5 Cal. Thus it might be possible to obtain α -C₆H₄NNH₂ from pyridine and NH₃ under the influence of dehydrogenating catalysts at higher temps. and the authors indeed obtained small amts. of α -C₆H₄NNH₂ with Ni- or Fe-asbestos at 410–500°. Without a catalyst or with a tube filled with burnt clay, traces of 2,2'-dipyridyl were obtained, showing that always the H atoms in position 2 are activated by heat.

The action of dibenzoyl peroxide on pyridine. J. OVERHOFF AND G. TILMAN, *Rec. trav. chim.* 48, 993–6(1929).—Bz₂O₂ reacts with org. compds., *e. g.*, hydrocarbons, according to the so-called "R. H. scheme" of Gelissen and Hermans (*C. A.* 19, 1564, 1858); if the same reaction takes place with pyridine according to the schemes 1 and 2:



(2)

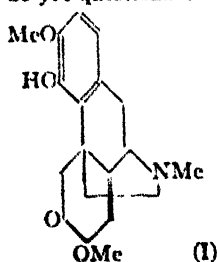
phenylpyridines are to be expected as the chief reaction products. The following products were obtained: α - and γ -C₆H₄NPh, benzene, CO₂, *p*-PhC₆H₄CO₂H and probably pyridylphenylbenzene. The reaction was allowed to proceed between 200 g. dry pyridine and 60 g. Bz₂O₂, only small amts. being added at a time and the excess of pyridine being distd. off after the reaction was over. The first cc. of the distillate was dissolved in dil. HCl and extd. with ether, 0.2-cc. benzene being obtained. On addn. of HCl to the residue a ppt. of acid and resinous products was obtained together with a soln. of basic products. From the latter a mixt. of α - and γ -phenylpyridine, *b.* 165–80°, was obtained which could be resolved into the components by repeated fractional extns. from ether with dil. HCl. Both isomers were obtained quite pure by conversion into the picrates, 9 g. α -phenylpyridine, *b.* 268–9° (picrate, *m.* 175°) and 5 g. γ -phenylpyridine, *m.* 74° picrate, *m.* 197.5° being obtained. The higher-boiling fractions of the filtrate gave 0.5 g. of a compd. *m.* 175°, which the authors consider to be *p*-pyridylphenylbenzene, this constitution being, however, not proved. The ppt. was dissolved in dil. alkali, leaving a resinous mass and giving a soln. from which the Na salt of *p*-PhC₆H₄CO₂H sep'd.; the acid itself was obtained from this salt and *m.* 220–1°. The filtrate of the Na salt of *p*-PhC₆H₄CO₂H on acidification gave 19 g. BzOH. The quant. detn. of the CO₂ formed during the reaction showed that this compd. was formed in 87.4% yield of the amount calcd. in accordance with scheme 1 or 2. In the presence of Cu the reaction between Bz₂O₂ and pyridine proceeds much more quickly; the action of the Cu, however, is not a catalytic one as it takes part in the reaction with the formation of (BzO)₂Ca.

C. F. VAN DUIN

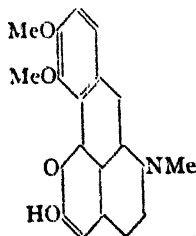
Hexamethylenetetramine-phenylcinchoninic acid. (Cinchophenurotropine.) L. VANINO AND F. MUSSGUG, *Arch. Pharm.* 267, 487–8(1929).—Equimol. wts. of hexamethylenetetramine and phenylcinchoninic acid in alc. give the compd. (CH₂)₆N₄·C₁₆H₁₁NO₂, *m.* 164°. Similarly, an aq. soln. of CS(NH₂)₂ (2 mols.) and (CH₂)₆N₄ (1 mol.) yield a cryst. compd., *m.* 176–7°.

W. O. E.

Sinomenine and disinomenine. VIII. Color reactions of sinomenine and sinomenol. KAKUJI GORO, *Bull. Chem. Soc. Japan* 4, 103–5(1929); cf. *C. A.* 18, 2710; 21, 1664–6; *J. Agr. Chem. Soc. Japan* 1, 3, 50, 89(1925).—Comparisons of sinomenine and thebainone, regarding their color reactions with alk. K₃Fe(CN)₆ (taken up by CHCl₃) and with diazo compds., and of sinomenol and 3-methoxy-4,6-dihydroxyphenanthrene regarding their color reactions with NH₂·AgNO₃ in Me₂CO convince G. that the sinomenine formula (I) of Kondo and Ochiai (*C. A.* 22, 4531–2) is superior to his provisional one (II). Only the linking point of the methylaminoethyl group is considered to be yet questionable.



(I)



(II)

G. TOENNIES

Synthetical experiments on the aporphine alkaloids. VII. Attempted syntheses of apomorphine dimethyl ether. JOHN M. GULLAND, ROBERT D. HAWORTH, CYRIL J. VIRDEN and ROBERT K. CALLOW. *J. Chem. Soc.* 1929, 1666-76; cf. *C. A.* 23, 4704.—While Me ethers of certain phenolic aporphine alkaloids have been obtained by the action of PCl_5 on suitably substituted amides in cold CHCl_3 , apomorphine di-Me ether could not be prepd. from $2,3,4\text{-O}_2\text{N}(\text{MeO})_2\text{C}_6\text{H}_2\text{CH}_2\text{CONHCH}_2\text{CH}_2\text{Ph}$. This lack of success and a similar failure to synthesize 3,4,5-trimethoxyaporphine led to the conclusion that the facile closure of the isoquinoline ring requires the presence of a strongly *p*-directive group in the *p*-position to that in which ring closure is* to take place. It was hoped that this activation might be attained and the difficulty overcome by the use of an acyl deriv. of $2,3,4\text{-O}_2\text{N}(\text{MeO})_2\text{C}_6\text{H}_2\text{CH}_2\text{CONHCH}_2\text{CH}_2\text{C}_6\text{H}_4\text{NH}_2\cdot 3$, but such was not the case. $\text{CHNa}(\text{CO}_2\text{Et})_2$ and $m\text{-O}_2\text{NC}_6\text{H}_4\text{CH}_2\text{Cl}$ give a mixt., which, after hydrolysis with 30% KOH, yields *Et di*[3-nitrobenzyl]malonate, *m.* 112°, and 3-nitrobenzylmalonic acid, *m.* 171° (decompn.), yielding at 180° $3\text{-O}_2\text{NC}_6\text{H}_4\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$. With SOCl_2 and concd. NH_4OH the latter yields β -3-nitrophenylpropionamide, *m.* 99°, transformed by NaOCl into β -3-nitrophenylethylamine-HCl, pale yellow, *m.* 207-9°, which in turn is reduced by SnCl_2 and HCl to β -3-aminophenylethylamine-di-HCl, *m.* 310° (decompn.). Condensation of the latter with $2,3,4\text{-O}_2\text{N}(\text{MeO})_2\text{C}_6\text{H}_2\text{CH}_2\text{COCl}$ with 10% NaOH gives 2'-nitro-3,4'-dimethoxyphenylacetyl- β -3-[2'-nitro-3',4'-dimethoxyphenylacetamido]phenylethylamide, which could not be crystd. and which gave no basic material with PCl_5 . Expts. were then undertaken to achieve the isoquinoline synthesis by using an amide in which the CH_2 group was replaced by a CO group, which could be reduced at a later stage. $\text{BzNHC}_6\text{H}_4\text{COCO}_2\text{H}$, obtained from isatin and NaOH, followed by BzCl , and $\text{PhCH}_2\text{CH}_2\text{NH}_2$ in Et_2O give β -phenylethylamine-2-benzamidophenylglyoxalate, *m.* 177.9° (decompn.); the amide could not be obtained from this with PCl_5 or P_2O_5 ; however, soln. of $\text{BzNHC}_6\text{H}_4\text{COCO}_2\text{H}$ in SOCl_2 , removal of the excess of SOCl_2 by repeated evapn. of the mixt. with dry C_6H_6 and addn. of $\text{PhCH}_2\text{CH}_2\text{NH}_2$ in C_6H_6 give 2-benzamidophenylglyoxyl- β -phenylethylamide, pale yellow, *m.* 136.5-8°, which is recovered unchanged after standing with PCl_5 in CHCl_3 for 1 month. The next method of attack started with the fundamental idea of the prepn. of a substituted desoxybenzoin ($\text{O}_2\text{N}(\text{MeO})_2\text{CH}_2\text{COC}_6\text{H}_4\text{CH}_2\text{CH}_2\text{NH}_2$), or an allied substance, which would not only undergo the Pechor reaction, forming a phenanthrene deriv., but would also lose with ease the elements of H_2O , yielding a dihydroisoquinoline. $2,3,4\text{-O}_2\text{N}(\text{MeO})_2\text{C}_6\text{H}_2\text{CH}_2\text{CN}$ and BzH in *N* NaOH 1 hr. at 55° give α -cyano-2-nitro-3,4-dimethoxyxystilbene, pale yellow, *m.* 125.5° which, however, was extremely stable to hydrolysis, and attempts to convert it into a deriv. of desoxybenzoin were unsuccessful. Similarly, $o\text{-C}_6\text{H}_4(\text{CHO})_2$ yields α -cyano-2-nitro-3,4-dimethoxy-2'-aldehydistilbene (I), *m.* 153° (phenylhydrazone, golden yellow, *m.* 179-80°), no cryst. acid was obtained when this was heated with $\text{CH}_2(\text{CO}_2\text{H})_2$ and piperidine in $\text{C}_6\text{H}_5\text{N}$. Attempts to reduce the NO_2 group of I directly to the NH_2 group were unsuccessful. Condensation of I with $m\text{-H}_2\text{NC}_6\text{H}_4\text{CO}_2\text{H}$ gives α -cyano-2-nitro-3,4-dimethoxy-2'-*m*-carboxyphenylaminomethylstilbene, yellow, *m.* 237° (decompn.); reduction in cold dil. NH_4OH with Fe_2SO_4 in a H atm. gives 2-[2'-*m*-carboxyanilinomethylphenyl]-3-cyano-6,7-dimethoxyindole, $\text{C}_{25}\text{H}_{21}\text{O}_4\text{N}_3$, or its dihydro deriv., $\text{C}_{25}\text{H}_{23}\text{O}_4\text{N}_3$, *m.* 225° (HCl salt, yellow, *m.* 307°, crystg. with 1 H_2O). The HCl salt with aq. AcONa gives a trihydrate, *m.* 320°, which, crystd. from 95% EtOH , forms a hexahydrate, *m.* 322°. Crystn. from glacial AcOH gives the anhyd. base. Piperonylidene-*m*-aminobenzoic acid, cream, *m.* 244-5°; the *p*-deriv., brown, *m.* 243°.

C. J. West

Properties of nicotine and its derivatives. II. Optical rotatory power and rotatory dispersion. THOMAS M. LOWRY and WM. V. LLOYD. *J. Chem. Soc.* 1929, 1771-91; cf. *C. A.* 23, 4475.—This work was undertaken mainly because the optical rotatory power of nicotine (I) can be measured with an accuracy that is roughly 10 times greater than in the case of other org. compds., and only 10 times less than in the case of quartz, since the observed rotation in a 6-dm. column of I ranges from 757° at 6708 to 2260° at 4358 Å. U. The numerous data are given in tables, for which the original should be consulted. The best values for the sp. rotation of I seem to be $[\alpha]_D^{20}$ 169.3°, $[\alpha]_{4358}$ 204.1°. The rotatory dispersion of I is nearly (but not quite) simple, with $\lambda_1 = 0.06$ the characteristic wave length is rather less than that of the max. of selective absorption. The hydrate in H_2O and the butyrate and crotonate in Me_2CO have nearly the same dispersion ratios as free I but their rotatory powers are much less. It is possible that I forms a pseudo-base, like those investigated by Decker in the isoquinoline series, and a series of pseudo-salts with weak acids. The isomethiodide is *l*-rotatory but its HI and MeI derivs. are *d*-rotatory with a nearly simple dispersion for which

$\lambda_1 = 0.03$. The ZnCl_2 compd. of I is also *d*-rotatory with very similar dispersion ratios. The reversal of sign on salt formation, which has been noticed also in brucine and conine and on benzoylation of tetrahydroquinidine, is associated in I with the satn. of a lone pair of electrons on the pyrrolidine N and is perhaps dependent on the elimination of an incipient dative bond between the 2 rings. A soln. showing anomalous rotatory dispersion has been prepd. by dilg. I acetate with H_2O . The significance of Darmon's rectilinear diagram and Armstrong and Walker's characteristic diagram is discussed.

C. J. WEST

The bromination of some natural alkaloids by the hydracid-hydrogen peroxide mixture. ALBERT MOREL, ALBERT LEULIER AND PAUL DENOVEL. *Bull. soc. chim.* [4], 45, 435-56(1929); cf. C. A. 19, 642.—The advantage of the halogenation by the hydracid- H_2O_2 mixt. is the possibility of regulating the rate of halogen liberation and of calcg. the amt. liberated. A list of the products obtained by this method by Leulier and his pupils is given. Generally, with I the tendency of addn. predominates while Br forms both addn. and substitution products and Cl tends more to substitution. In the present work HBr of either 13.9% or 61.7% and H_2O_2 of 2.2% (sometimes higher) was used. To the alkaloid dissolved as a HBr salt in an excess of the H_2O_2 soln. the HBr is added in small portions up to the amt. calcd. from the equation $2\text{HBr} + \text{H}_2\text{O}_2 = 2\text{Br} + 2\text{H}_2\text{O}$, this reaction being quant. if the reaction mixt. is not too dil. When a yellow color persists the reaction is considered finished, and the product is isolated. The reaction may continue in the filtrate. Sometimes more than the calcd. amt. of both H_2O_2 and HBr has to be added in order to start the reaction. Greater diln. generally produces the better defined products. No alkaloid aminoxides were formed as was proved by 2 sp. tests which are described. *Dibromococaine-HBr* (I), $\text{C}_{17}\text{H}_{21}\text{Br}_2\text{NO}_4$. HBr, yellow-orange, m. 130° , was obtained from 1 g. cocaine-HBr, 50 cc. 2.1% H_2O_2 and 10 cc. HBr. Four g. atropine sulfate, 200 cc. H_2O , 12 cc. *N* NaOH and then 25 cc. 30% H_2O_2 and 16 cc. concd. HBr form 4 g. of red crystals, m. 129.5° , of *tribromatropine-HBr* (II). Five g. quinine-HBr and 20 cc. 48% HBr form, on gradual addn. of 4 cc. 30% H_2O_2 , a yellow-orange powder which carbonizes at about 200° , *quinine perbromide-HBr*, $\text{C}_{20}\text{H}_{24}\text{Br}_2\text{N}_2\text{O}_7$. 2HBr. Br₂. Sparteine sulfate pptd. by NaOH and redissolved in HBr gives on alternate addn. of HBr and H_2O_2 an amorphous yellow ppt., m. 92° (cor.), of *tribromosparteine-HBr* (?) (IV). To 5 g. strychnine, 400 cc. H_2O and 12.5 cc. concd. HBr is added 30 cc. 30% H_2O_2 , 7.4 g. of a yellow greenish amorphous powder is obtained which carbonizes at about 200° , *bromostychnine dibromide* (V), $\text{C}_{21}\text{H}_{21}\text{Br}_2\text{N}_2\text{O}_4$. Br₂. Five g. morphine-HCl, 150 cc. H_2O_2 and 2 cc. HBr or 2 g. morphine, 10 cc. HBr and 5 cc. H_2O_2 give white crystals, m. about 221° (decompn.), of *bromomorphine-HBr* (VI), $\text{C}_{17}\text{H}_{19}\text{BrNO}_3$. HBr, $[\alpha]_D^{25} 1^\circ 15'$ (0.5% in H_2O). Two g. morphine-HCl, 10 cc. HBr and 100 cc. H_2O_2 give a yellow ppt. which carbonizes at about 200° , *tetrabromomorphine-HBr* (VII), $\text{C}_{17}\text{H}_{15}\text{Br}_4\text{NO}_3$. HBr. Two g. heroine, 10 cc. HBr, and 100 cc. H_2O_2 give white crystals of *bromoheroine-HBr* (VIII), $\text{C}_{17}\text{H}_{17}\text{BrNO}_3$. (OAc)₂. HBr. Some of the products contain H_2O of crystn. The methods of analysis used are described. Expts. on mice showed that the toxicity of VI is twice and of VIII is 8 times as great as that of morphine-HCl.

G. TOENNIES

The bromination of novocaine by the hydracid-hydrogen peroxide mixture. ALBERT MOREL, ALBERT LEULIER AND PAUL DENOVEL. *Bull. soc. chim.* [4], 45, 457-63 (1929); cf. preceding abstr.—By treating 5 g. novocaine with 5 cc. HBr and 50 cc. H_2O_2 are obtained white crystals, m. 217° , of *dibromonovocaine-HBr* (I), $\text{C}_{13}\text{H}_{18}\text{Br}_2\text{N}_2\text{O}_4$. HBr, constituting the 3,5-dibromo-*p*-aminobenzoylethylaminoethanol. It has 10 times as much anesthetic power as novocaine but its toxicity is also 10 times that of novocaine and 3 times that of cocaine.

G. TOENNIES

Sparteine. II. K. WINTERFELD. *Arch. Pharm.* 267, 433-55(1929); cf. C. A. 22, 2751.—The present investigations show that scission of the sparteine mol. by the aid of BrCN yields differing results according to the conditions of the expt. and of the temp., as seen in the properties of the two resulting monobromocyanamides and their subsequent degradation. The degradation product of the oily monobromocyanamide is regarded, with suitable reserve, to be a *l*-rotatory α -methylquinuclidine. The 2nd tertiary-cyclic N atom forms part of a pyrrolidine ring, as shown by the formation of α -methylpyrrolidine after the combined oxidative and phosphohalide degradation. I. Action of cyanogen bromide on sparteine. WITH F. W. HOLSCHNEIDER.—Sparteine and BrCN in equimol. proportions react readily with the formation among other things of *dibromosparteine dicyanamide*, $\text{C}_{17}\text{H}_{20}\text{N}_4\text{Br}_2$, a bright yellow varnish-like mass (*aurate*, $\text{C}_{17}\text{H}_{20}\text{N}_4\text{Br}_2 \cdot \text{HAuCl}_4$, m. $144-5^\circ$), and 2 isomeric *monobromosparteine cyanamides*, $\text{C}_{17}\text{H}_{20}\text{N}_4\text{Br}$, the *crystal. form* (I) m. 89° (*aurate*, $\text{C}_{17}\text{H}_{20}\text{N}_4\text{Br} \cdot \text{HAuCl}_4$, bright yellow, m. 178° ; *picrate*, lemon-yellow, m. 165° ; *HgCl* salt, m. 117°), and the

reddish yellow oily form (II) (aurate, $C_{16}H_{28}N_2Br \cdot 2HAuCl_4$, m. 181° (decompn.); picrate (1 mol. base + 2 mols. picric acid), m. 176° (decompn.)). An addn. product of sparteine with BrCN in abs. Et_2O , $C_{16}H_{28}N_2Br$, air-stable crystals soften about 230° , finally flowing to a yellow oil. I gave with Sn and HCl the cyanamide, bright yellow thick oil (aurate, $C_{15}H_{27}N_3 \cdot HAuCl_4$, m. $186-7^\circ$), which on heating with 60-65% H_2SO_4 yielded a light brown oil (aurate, $C_{15}H_{28}N_2 \cdot 2HAuCl_4 + C_{15}H_{28}N_2 \cdot HAuCl_4 + HCl$, m. $130-1^\circ$; picrate, $C_{15}H_{28}N_2 \cdot 2C_6H_5(NO_2)_3OH$, m. 179° , $[\alpha]_D^{20} -16.3^\circ$). With BzCl the secondary base gave a heavy oil (platinate, $(C_{22}H_{32}ON_2)_2H_2PtCl_6$ and aurate, $C_{22}H_{32}ON_2 \cdot HAuCl_4$, m. 145° (decompn.)). 2. Oxidative splitting of sparteine and ring opening with phosphorus pentabromide. With C. v. RAUCH. Among the scission products arising from the action of PBr_5 on the Bz deriv. of the secondary base was a product yielding a platinate, rosetts, m. $248-9^\circ$, and an aurate, $C_{11}H_{17}N_2 \cdot HAuCl_4$, m. $178-9^\circ$. Degradation of II gave a cyanamide (aurate, $C_{10}H_{17}N_3 \cdot 2HAuCl_4$, m. 172° (decompn.)), and picrate, amorphous powder m. $172-3^\circ$ (decompn.)). Heating with H_2SO_4 effected elimination of the CN group with formation of an oily syrup (aurate, m. $181-2^\circ$ (decompn.); picrate, needles, m. 178° ; and platinate, $C_{15}H_{28}N_2 \cdot H_2PtCl_6$, m. 257° (decompn.)). Bz deriv. of the secondary base (aurate, $C_{22}H_{32}ON_2 \cdot 2HAuCl_4$, m. 185° (decompn.)), and platinate, $C_{22}H_{32}ON_2 \cdot H_2PtCl_6$, m. $248-9^\circ$ (decompn.)). Further scission of the secondary cyclic amine gave the aurate, $C_8H_{13}N \cdot HAuCl_4$, m. $196-7^\circ$ (decompn.), platinate, $(C_8H_{13}N)_2 \cdot H_2PtCl_6 \cdot H_2O$, m. 255° , III salt, $C_8H_{13}N \cdot HI$, m. 227° , picrate, m. 180° , and methiodide, m. 205° . W. O. F.

Oleosylvic acid. F. BALAŠ AND R. HAZUKOVÁ. *Collection Czechoslovak Chem. Communications* 1, No. 7, 401-10 (1929).—The oleosylvic acid, isolated by F. Schulz from the resin oil of American *colophony*, has been resolved into 2 structurally different resin acids, *d*-pimaric acid and the *d*-rotating abietic acid. The sepn. was effected by fractional crystn. of the *di*-amylamine salt. The isolated *d*-pimaric acid has been identified and crystallographically detd. The additive salts of these 2 acids with Pr_2NH , *di*-*d*-amylamine, piperidine, quinine, quinidine and cinchonidine form white, silky, tasteless, odorless needles, which melt without decompn. and are sol. in water. Chem., phys. and crystallographical data are given.

CHARLES J. PEDERSEN

The constitution of olivil from olive resin. BORTOLO L. VANZETTI. *Monatsh.* 52, 163-8 (1929).—A series of earlier articles on olivil by Korner and his collaborators are summarized since they were published in little known journals. By extn. of good olive resin with boiling $EtOH$ or $MeOH$ crystd. olivil (I) contg. 1 mol. alc. of crystn. is obtained in 50% yield. It seps. from H_2O with 1 mol. H_2O . The solvent of crystn. is given off on heating in an indifferent gas and amorphous I results which slowly becomes cryst. From Me_2CO , Me_3COH and $PhCH_2OH$ it crystallizes without solvent. The following compds. were analyzed. Olivil, $C_{26}H_{42}O_2$; anhyd. amorphous, softens at $66-70^\circ$; anhyd. cryst., m. 142.5° ; hydrate, m. 105° ; olivil Me alcoholate, m. 97° ; Et alcoholate, m. 120° ; Pr alcoholate, m. 104° ; iso-Pr alcoholate, m. 101.5° ; allyl alcoholate, m. $100-5^\circ$. I has $[\alpha]_D^{20} -127^\circ$ (H_2O , c 0.314). I is easily dissolved by strong alkali and reprecip. by CO_2 ; dry distn. gives creosol, concd. KOH or NaOH at higher temp. forms vanillin; it dissolves in concd. H_2SO_4 with strong red-brown color and, on addn. of H_2O , seps. again; it resinifies on heating with dil. mineral acids; oxidation with $KMnO_4$ in boiling $AcOH$ forms acetylvanillic acid. The mol. contains 2 phenolic OH groups and 2 OMe groups. The following derivs. were made: *di*-Me, m. 156° ; *di*-Et, m. 182° ; *di*-Pr, m. 135.5° ; *dibenzyl*, m. below 150° ; Me, m. 238° ; Et, m. 145° . Ethylation of methylolivil and methylation of ethylolivil give an identical methyl-ethylolivil, m. 169° . Oxidation of dimethylolivil with alk. $KMnO_4$ on the steam bath yields about 50% each of veratric acid and veratroylformic acid. By Br only substitution products were formed: bromodimethylolivil, m. 128° , and dibromodimethylolivil, m. 132° ; the latter forms on oxidation with $KMnO_4$ 3-bromoveratric acid and 3-bromoveratroylformic acid. O_3 does not act upon I. Dimethyl-, diethyl- and methylethylolivil can be acetylated with Ac_2O at 145° . All esters are *l*-rotatory. By treating I with boiling dil. $AcOH$ or HCO_2H (1:4) isolivil (II) is formed in quant. yield. It crystallizes with the same crystal solvents as I, but also with Me_2CO and Et_2O . Like I it contains 2 phenolic OH groups and 2 OMe groups. II has $[\alpha]_D^{20} 352^\circ$ (H_2O , c 0.397). Derivs.: *di*-Me, m. 184.5° , *di*-Et, m. 179.5° ; Me ($2H_2O$), m. 150° , from $MeOH$ m. 150° , then 207° ; Et ($2H_2O$), m. 150° . In contrast with I, methylation of the Et compd. and ethylation of the Me compd. give 2 different compds.: ethylmethylisolivil, m. 192° , and methylethylisolivil, m. 168° . Also prepd. was benzylmethylisolivil, m. 174° . Derivs. of II never changed into derivs. of I. Investigation of II is being continued while for I the formula $[HO(MeO)C_6H_4CH_2CH_2C(OH)-]_2O$

is suggested and its formation by condensation of 2 mols. coniferyl alc. under partial oxidation is assumed.

G. TOENNIES

Saponins, sapogenins and analogous compounds. I. A trimethylnaphthalene from gypsogenin. L. RUZICKA AND A. G. VAN VEEN. *Rec. trav. chim.* **48**, 1018-24 (1929).—Very little is yet known of the C skeleton of the sapogenins, but several authors have expressed the opinion that there would be some correlation with the terpenes and especially with the sesquiterpenes (cf. Sieburg in *Abderhalden's Handbuch der biologischen Arbeitsmethoden*, Abt. I, Teil 10, Heft 2, 545, 580(1921)) while others hold the opinion that structural relations exist between sapogenins and sterols and bile acids (cf. van der Haar, *C. A.* **16**, 3639; Windaus, Hampe and Rabe, *C. A.* **21**, 589). An exact proof of these constitutional relations has, however, never been given. R. and v. V. have now obtained a trimethylnaphthalene by the same procedure which R. and Huyser (*Z. angew. Chem.* **41**, 843(1928); *Ann.* **471**, 21(1929)) successfully applied to the amyrins. On heating the amyrins at 400-50°, a mixt. of hydrocarbons, b_{11} 70-160°, was obtained, the fraction b_{11} 115-25° having about the compn. $C_{17}H_{26}$. On dehydrogenation with S, or better with Se according to Diels, a trimethylnaphthalene was obtained which gave a picrate, m. 127-8°, and a styphnate, m. 152-3°, and on oxidation with $K_3Fe(CN)_6$ yielded a naphthalenetetracarboxylic acid, which could be characterized by a well crystd. Me ester, m. 152-3°. The same methods were applied to gypsogenin: the "saponinum crudum" (Merck) was hydrolyzed by heating with dil. aq. alc. H_2SO_4 at 140-50° in an autoclave; extn. of the filtrate with ether gave the gypsogenin which could be purified by crystn. from EtOH; it m. 275°; yield 5%. The thermal decompn. of the sapogenin itself gave only a small yield of a volatile oil, better results being obtained with the Me ester, which was prepd. from the Na salt and MeI in MeOH; it m. 192° (cf. Rosenthaler and Ström, *Arch. Pharm.* **250**, 296(1912)). On heating this Me ester at 400-50° in CO_2 , a distillate is obtained the principal fraction of which b_{12} 135-50° and has the compn. $C_{17}H_{26}O$, the O atom being an ethereal one (no formation of a semicarbazone and no evolution of CH_4 according to the method of Zerevitinov). On dehydrogenation with the same amt. of Se at 300-20°, a reaction product was obtained which gave a picrate, m. 127-8°, identical with the trimethylnaphthalene picrate obtained from the amyrins. The dehydrogenation of gypsogenin itself with Se, without previous heating at 400-50°, yielded the same picrate and also the same styphnate, m. 152-3°, as prepared from the amyrins. The oxidation of the hydrocarbon itself with $K_3Fe(CN)_6$ (cf. Weissberger and Kruber, *C. A.* **13**, 2357; R. and Rudolph, *C. A.* **22**, 1154) gave a naphthalenetetracarboxylic acid which was converted by means of the Ag salt into the tri-Me ester, m. 152-3°, and again identical with the Me ester prepd. from the amyrins. The dehydrogenation of cholatricnic acid, prepd. by heating cholic acid at 350°, with Se only yields a trace of a picrate which could not be identified. From these results it follows that the gypsogenin must be structurally related to the amyrins, both differing from cholesterol and the bile acids (Windaus, Hampe and Rabe, *l. c.*).

C. F. VAN DUIN

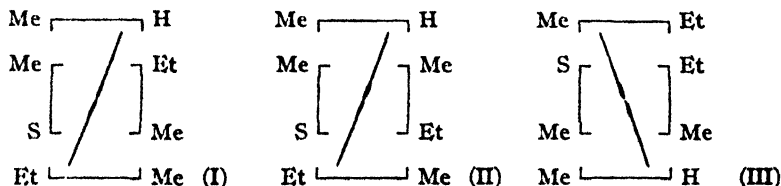
Chlorophyll. IV. Degradation of chlorophyll by alkalis. ALFRED TREIBS AND ERWIN WIEDEMANN. *Ann.* **471**, 146-235(1929); cf. *C. A.* **23**, 1414.—Pheophytin is a mixt. of pheophytin-*a*, m. 178-80° (sinters 150°), and pheophytin-*b*, m. 190-5° (sinters 170°). The anal. figures obtained for chlorin-*e* (I) are in agreement with those previously given for rhodin-*g* (II). By the action of CH_3N in Me_2CO , chlorin-*c* Me ester, m. 215° (cor.), and rhodin-*g* ester, m. 251° (cor.), are obtained; these are hydrolyzed by short treatment in C_2H_5N with $MeOH-KOH$, while treatment of $CHCl_3$ solns. with $Cu(OAc)_2$ in $MeOH$ yields chlorin-*e* ester and rhodin-*g* ester Cu salts, both m. 225° (cor.). The actions of the following reagents on I and II were examd. in detail: 30% $MeOH-KOH$ (III); III and 0.5 vol. of C_2H_5N in which the substance is previously dissolved (IV); IV with addn. of MgO (V); 0.5 vol. of C_2H_5N and 1 vol. of 5% Na_2O in $MeOH$ (VI); 0.5 vol. of C_2H_5N and 1 vol. of 25% $MeOH-NaOH$ (VII). I, treated with reagent VII in a Ag vessel at 125° under pressure, II treated with VI at 130° or pheophytin (*a* + *b*) treated with IV at 100°, all led to the isolation of *verdoporphyrin*, $C_{22}H_{24}N_4O_4$ (VIII), bluish red-violet needles from cold Et_2O , 6-sided leaflets after heating some time in the Et_2O mother liquor, which are olive brown or bluish violet; HCl no. 6, p_H no. 6.8; the distribution no. towards 3.5% HCl is 0, towards 6% HCl 34. A 6% HCl soln. is greenish blue, a 12% soln. bluish green and more concd. solns. a pure green. The absorption spectrum is very characteristic. VIII, its derivs. and its solns. decomp. even in the absence of light, giving the isomeric rhodoporphyrin (IX). The *di-Me* ester of VIII m. 280° (cor.) and is spectroscopically identical with VIII. The *Cu* complex, $C_{22}H_{22}N_4O_4Cu$, is reddish violet; the *Mg* complex (*verdophyllin*) is very stable in Et_2O . Further degradation of VIII by VII, IV, VI and H_2SO_4 produces

IX, IX plus a trace of pyrrporphyrin (**X**), some phylloporphyrin and **X**, resp. By-products in the decompn. of I include *chlorin-3*, which may not be a chem. homogeneous compd. and *chlorin-10*, which may be identical with *phytychlorin-f*; the latter yields a *Me ester*, m. 203° (cor.), whose *Cu salt* m. 210° (cor.). **VIII** is contained in the cyano- and glaucoporphyryns of Willstätter. Treatment of I according to conditions V at 150°, **II** according to VI at 140° and pheophytin (*a + b*) according to IV gave **IX** (*Mg complex*); *di-HCl salt*; *di-Me ester*, m. 268° (cor.) (*Cu complex*, m. 243°; *Fe complex*, m. 294°, crystg. with 1 MeOH which is lost at 110°). Oxidation of the *di-Me ester* in CHCl_3 by PbO_2 and AcOH gives a *xanthoporphinogen*, yellow, m. 284° (cor.). **IX** under conditions VII in a sealed tube gives **X**; erythrophyllin and erythroporphyrin with IV also give **X**; it is concluded that erythroporphyrin is a very pure **IX**. From **II** and VI at 150° in a sealed tube a mixt. of phyllo-, pyrro- and rhodoporphyryns was obtained. *Phylloporphyrin-HCl* and the *Me ester Cu complex*, m. 255° (cor.), are described. Phylloporphyrin and EtONa in $\text{C}_6\text{H}_5\text{N}$ give *phyllocholorin*, whose *Me ester* m. 164° (decompn.); reduction with Zn and AcOH gives a *leuco compd.* From the porphyrin mixt. obtained from **II** pyrroporphyrin was obtained; the *Cu complex* and the *Me ester Cu salt*, m. 231° (cor.), are described. From this *pyrrochlorin* was prepd. analogously to phyllocholorin; when warmed with H_2SO_4 it is converted into pyrro-*rhodin*. Distribution coeffs. of, and spectroscopic data for, the derivs. described are tabulated. V. Acetates of porphyrin and hemin and the constitution of rhodoporphyrin. H. FISCHER, G. HUMMEL AND A. TREIBS. *Ibid* 237-85.—Hemin extd. with Ac_2O gives *acetic anhydride-hemin (chlorohemin diacetate)*(I), from which hemin can be regenerated by treatment of I in CHCl_3 with boiling AcOH . I and HBr-AcOH give hematoporphyrin- HCl . I and MeOH with a trace of H_2SO_4 or HCl give *tetramethylhematoporphyrin Fe salt*, $\text{C}_{35}\text{H}_{40}\text{O}_6\text{N}_4\text{FeCl}$. Reduction of I gives mesoporphyrin. I and hot collidine give *collidine-hemin*, $\text{C}_{34}\text{H}_{32}\text{O}_4\text{N}_4\text{FeCl}$. $\text{C}_6\text{H}_{11}\text{N}$, which gives I when crystd. from Ac_2O ; the same compd. is obtained from the allohemin of Kuhn and Seyffert (*C. A.* 22, 3419) and from mesohemin. *Pyrrporphyrin acetate*, m. 183° (all m. ps. cor.), crystals, on cooling the Ac_2O soln.; it is not sapon. by 2% NaOH but is quant. decompd. by 10% NaOH in a few min. *Mesoporphyrin acetate*, m. 225°; *Cu complex*, red, m. 197°. *Mesorhodin acetate*, m. 225°, sapon. about 50% by 3% HCl in 3 min. *Protoporphyrin acetate*, dark violet, m. 231°; AcOH is lost at 60°; HCl no., 5. *Phylloporphyrin acetate*, brown, m. 220°; HCl no., 0.7. *Rhodoporphyrin diacetate*, acid no. 8.5, m. 199°; *rhodoporphyrin Me ester*, by addn. of MeOH to rhodoporphyrin in HBr-AcOH , sinters 285°, m. 330°; *FeCl complex*; *acetate*, violet, m. 208°, acid no. 9. *Coproporphyrin I-acetate*, m. 182°. Uroporphyrin acetate, by the action of Ac_2O in $\text{C}_6\text{H}_5\text{N}$. *Mesoacetoxihemin acetate*, violet-black, m. 235°. *Mesochlorohemin acetate*, m. 260°, is identical with K. and S.'s allomesohemin. *Mesoacetoxihemin di-Me ester*, m. 237°. *Protoacetoxihemin acetate*, m. 204°. *Protochlorohemin acetate*, m. 248°, identical with allohemin, converted by 5% NaOH in CHCl_3 and crystn. from Ac_2O into the *Ac deriv.* *Protohemin acetate*, does not have a sharp m. p. *Dimethylhemin*, m. 232°. *Phylloacetoxihemin acetate*, steel-gray or violet-black, m. 327°; the *Cl analog* m. 329°. *Pyrroacetoxihemin acetate*, shows no m. p. on the block; the *Cl analog* m. 271°. Coproporphyrin I and $\text{Fe}(\text{OAc})_3$ in Ac_2O give *coproacetoxihemin acetate I*, black-brown, decomp. after standing 3 months. Etioporphyrin I and etioporphyrin I crystallize unchanged from Ac_2O . *Etiacetoxihemin*, blue-black, m. 355° (not cor.), results from the *Cl compd.* with 10% NaOH and crystn. from Ac_2O . The following *anhydrides* were prepd. by heating the acetates: *Rhodoporphyrin*, its *Me ester*, *phylloporphyrin*, *pyrrporphyrin*, *mesoporphyrin*, *mesochlorohemin* and *protoporphyrin*. Spectra are given for most of these compds. VI. Synthesis of chlorins. H. FISCHER AND H. HILBERGER. *Ibid* 285-304.—The hemin resulting from the treatment of porphyrin- HCl in AcOH with $\text{Fe}(\text{OAc})_3$ and NaCl in AcOH is suspended in iso- AmOH and Na added in a H atm. From the mixt. of porphyrin Fe salts, chlorin Fe salts, perhydrochlorin (I), chlorin (II) and traces of porphyrin, I and II are extd. by 18% HCl . Final sepn. by 8% HCl gives *chlorinmonocarboxylic acid* (III), moss-green, m. 217° (cor., decompn.); neutral solns. are green with red fluorescence; the HCl soln. is blue; shaking the Et_2O soln. with alkali causes loss of fluorescence. The Na , K and NH_4 salts are light green, amorphous flakes. The HCl no. is 7.5; it does not contain active H . *Me ester*, moss-green, m. 152° (cor.); its *Cu complex*, $\text{C}_{34}\text{H}_{38}\text{N}_4\text{O}_2\text{Cu}$, is blue-green and is transformed by 3% oleum in the cold after several days or by concd. H_2SO_4 at 100° for 20-30 min. into *anhydride a*, $\text{C}_{34}\text{H}_{32}\text{N}_4\text{O}$, blue-violet, m. 285° (decompn.), HCl no., 3.5, and *anhydride b*, blue, m. 282° (decompn.), HCl no., 11. III is decompd. by satd. MeOH-KOH at 180° to porphyrinmonocarboxylic acid and by Zn and AcOH to the same compd. (not obtained pure). Complex salts of III

with Fe, Cu and Mg are described. The spectra of many of these compds. are given.

C. J. WEST

Porphyrin syntheses. XXIV. Synthesis of three porphyrins, a rhodoporphyrin, pyrroetioporphyrin and also deuteroporphyrin. HANS FISCHER AND ANTON SCHOR-MULLER. *Ann.* 473, 211-49(1929); cf. *C. A.* 23, 4225.—Theoretically there are 8 pyrroetioporphyrins, which give rise to 24 pyrroporphyrins. Of these 3 are synthesized by methods given below: *Pyrroporphyrin 6* (I), 18 (II) and 21 (III) ($S = CH_2 \cdot CH_2 \cdot CO_2H$). Cryptopyrrolecarboxylic acid (1.7 g.) and 1.2 g. dimethylpyrrolealdehyde in 12 cc. EtOH to which is added 1 cc. HBr give 85% of [5,3-dimethylpyrryl]-[5',3'-dimethyl-4'-propionic acid-pyrrolenyl]methene (IV), yellow, m. 172°, isolated as the HBr salt (V), yellowish red, m. 223° (decompn.). V and 1 mol. Br in AcOH give the *mono-Br deriv.*, $C_{34}H_{40}O_2N_2Br_2$, light brick-red, m. 228-30°; the free base could not be obtained, but the free *Et ester*, light yellow, m. 106°, results by heating with 5% EtOH-HBr and liberation of the base with NH_3 . IV and 3 mols. Br give the *di-Br deriv.* of V, carmine-red, does not m. 245°. Melting 1.17 g. [5-bromo-4-ethyl-3-methylpyrryl][5'-bromo-4'-ethyl-3'-methylpyrrolenyl]methene-HBr and 1.32 g. IV with 3.5 g. (CH_3CO_2H), gives 15% of I, $C_{31}H_{34}O_2N_4$, whose HCl no. is 1.5; the spectrum in EtOH-AcOH and in 2% HCl is given. The *Me ester* m. 228°; HCl no. 2.5; *Cu salt*, red-violet, m. above 300°; $Fe(OAc)_2$ and NaCl in AcOH give the *hemin*, $C_{31}H_{32}O_2N_4FeCl$, violet. With the Grignard reagent, followed by decompn. with NH_4Cl , there results the rose-red, strongly fluorescing soln. of the *phyllin*, while warming with concd. H_2SO_4 80 min. on the H_2O bath gives the *rhodin*, dark bluish violet needles, whose HCl no. is 4; its Cu salt is difficult to cryst. C_8H_8N and $EtONa$ with I at 180-90° give the *chlorin*, which gives a grass-green soln. and is sol. in HCl with a dark blue color. Melting [3-ethyl-4-methyl-5-bromopyrryl][3'-ethyl-4'-methyl-5'-bromopyrrolenyl]methene (VI) and IV with (CH_3CO_2H), at 180-200° gives 10-12% of III; $MeCH(CO_2H) \cdot CH_2CO_2H$ gives a 15% yield and the process of purification is simpler; it resembles



I in its properties. The *Me ester* m. 218-9°; the *hemin* forms bluish black leaflets (Cu salt, sinters 270° and m. about 300°); the *rhodin* is obtained in about 40% yields. The *hemin* with Ac_2O and $SnCl_4$, shaken 10-12 min., and then heated with AcOH-HBr at 40° for 5 hrs., gives the *compd.* $C_{33}H_{38}O_2N_4$. Melting [3-ethyl-4-methyl-5-bromopyrryl][3'-methyl-4'-ethyl-5'-bromomethylpyrrolenyl]methene-HBr and the methene from 2,4-dimethylpyrrolealdehyde and opsopyrrolecarboxylic acid with (CH_3CO_2H)₂ at 180-200° gives II, whose *Me ester* m. 248°. Cryptopyrrolecarboxylic acid (2.55 g.) and 3.0 g. 2,4-dimethyl-3-carbethoxy-5-formylpyrrole give 4.5 g. [5,3-dimethyl-4-carbethoxypyrryl][5',3'-dimethyl-4'-propionic acid-pyrrolenyl]methene-HBr (VII), m. 205°; bromination gives a perbromide, m. 164°, which, crystd. from Me_2CO , gives the *compd.* $C_{31}H_{34}O_4N_2Br_2$, m. 203-6°; bromination of this perbromide-HBr with 2 mols. Br in AcOH (heating 15 min. under reflux) gives a methene, m. 219°, which contains no perbromide and is not changed by crystn. from Me_2CO ; esterification gives the *compd.* $C_{29}H_{32}N_2O_4Br(?)$, yellow, m. 169°; the free base m. 100°. Heating VI and VII with (CH_3CO_2H)₂ over a free flame gives 4-6% of the *Et ester*, m. 290°, HCl no. about 6-7, of *rhodoporphyrin 21*, violet rhombs, HCl no. 3.5-4; the *di-Me ester*, m. 218°, HCl no. 7 (Cu salt, red, m. 239°); *hemin*, m. 306°; *phyllin*, greenish red soln. with strong red fluorescence. Decarboxylation gives III. Melting [3,5-dimethyl-4-ethylpyrryl][3',5'-dimethyl-4'-acetylpyrrolenyl]methene-HBr and the HBr salt of VI with (CH_3CO_2H)₂ gives 2-3% of *acetyl-1,4,6,7-tetramethyl-3,5,8-triethylporphyrin* (acetylpyrroetioporphyrin), does not m. 290°; a by-product is a porphyrin with a HCl no. of 7-8. Condensation of cryptopyrrolealdehyde with 2,4-dimethyl-3-acetylpyrrole in EtOH with HBr gives [3,5-dimethyl-4-ethylpyrryl][3',5'-dimethyl-4'-acetylpyrrolenyl]methene-HBr, m. 237° (decompn.); the free base, light yellow, m. 159°; bromination of the HBr salt in AcOH at 40-50° gives a yellow red *perbromide*, m. 202°. 2-Carbethoxy-1,4,6,7-tetramethyl-3,5,8-triethylporphyrin, m. 264°; *Me ester*, m. 262°, HCl no., 8.5; the HCl salt seps. from 20% HCl. Melting the HBr salt of VI and [3-methyl-5-bromomethylpyrryl][3'-methyl-4-ethyl-5'-bromomethylpyrrolenyl]methene-HBr

with $(\text{CH}_3\text{CO}_2\text{H})_2$ gives 1,4,6,7-tetramethyl-2,3,8-triethylporphyrin (pyrroetioporphyrin VII), needles, HCl no. 2.5; Br deriv; chlorin. Opsopyrrolecarboxylic acid and 2,4-dimethylpyrrolealdehyde give [3-methyl-4-propionic acid-pyrrole][3',5'-dimethylpyrrolenyl]methene-HBr, red needles, m. 220-1° (decompn.); the Br deriv., brick-red, darkens at 200° but does not m. 280°; deuteroporphyrin 5 gives a di-Me ester, m. 300° (Cu salt, m. 281°); hemin, red-brown. The effect of temp. upon the spectra of porphyrin derivs. is reported.

C. J. WEST
Synthesis of hemin. H. FISCHER. *Naturwissenschaften* 17, 611-7(1929)—A review (cf. C. A. 23, 2185).

B. J. C. VAN DER HOEVEN
From acrolein to hemaglobin passing through the antioxygens and colored hydrocarbons, forming dissociable peroxides (rubrenes). CHARLES MOUREU. *Rec. trav. chim.* 48, 826-37(1929).—A review is presented of the work, theoretical and exptl., of Moureu, Dufraisse and their collaborators, special stress being laid on the importance of the discovery of the dissociable peroxides of rubrene (tetraphenyldibenzodifulvene) for biol. science.

C. F. VAN DUIN
Lactucarium. K. H. BAUER AND E. SCHUB. *Arch. Pharm.* 267, 413-24(1929).—Examn. of lactucerin and lactucrol, isolated from lactucarium, has been taken up anew. The lactucerin was recrystd. in part from hot alc., in part from petroleum ether, but it proved to be extremely difficult to obtain this substance, as also lactucrol, with const. m. p. and optical rotation. The highest m. p. for the former was 232-3° after 14 recrystns. ($[\alpha]_D^{20}$ 39.08° after 9 recrystns.). The differences between the present values and those reported by other investigators are probably due to the fact that lactucerin is a mixt. of 2 isomeric acetates of lactucrol, the α -form being more difficultly sol. in the usual solvents than the β -form. α -Lactucrol m. 203° after 8 recrystns., ($[\alpha]_D^{20}$ 78.44°), while β -lactucrol (benzoate m. 260°) m. 165° ($[\alpha]_D^{20}$ 53.8°). The formula for lactucrol was found to be $\text{C}_{30}\text{H}_{44}\text{OH}$. Ozone oxidation of the α -form yielded the unsatd. hydrocarbon α -lactucene, $\text{C}_{30}\text{H}_{38}$, m. 207°, and apparently identical with the hydrocarbon (m. 210°) yielded by the β -form under similar treatment. This behavior is unlike that observed in the conversion of amyryl into amyrylene. From the behavior of lactucrol under O_3 treatment the conclusion is drawn that the OH group forms no part of the ring system but rather of an aliphatic side chain. Herein lies the principal difference between lactucrol and possibly the resin alcs. in general and the sterols, although it does give in the α -form with digitonin a digitonide ppt. It is further concluded that lactucrol represents a secondary alc., otherwise the O_3 treatment should yield among other things a ketone. Reduction of lactucrol with HI or hydrogenation of lactucene yielded the hydrocarbon lactucane, $\text{C}_{30}\text{H}_{50}$.

W. O. E.

Magnetic behavior of some organic crystals (BHAGAVANTAM) 2. Determination of the H value of unsaturated compounds (WATERMAN, *et al.*) 2. The Raman effect in some organic liquids (VENKATESWARAN) 3. Cellulose (HESS, TROGUS) 23. The cellulose problem (MEYER, MARK) 23. The problem of the separation of erepsin and trypsin or trypsin-kinase into fractions with specific action (ABDERHALDEN, SCHMITZ) 11A. Röntgenometric examination of highly polymerized organic substances (OTT) 2. Irreversible transformations of organic compounds under high pressures (BRIDGMAN, CONANT) 2. Chemistry of starch (IRVING) 28. Formation of *l*-malic acid from fumaric acid by *Aspergillus niger* (CHALLENGER, KLEIN) 16. Magnetic birefringence in liquids of the aliphatic series (RAMANADHAM) 2. Orientation polarization observed in the case of C_{60} -derivatives (SCHLEED, *et al.*) 2. Viscosity of vapors of organic compounds (TITANI) 2. Spectrographic study of alkaloids of Japanese menispermaceae (OCHIAI) 17. Calorimetric researches. XVIII. Some measurements on the 2 hydrobenzoins (VERKADE, COOPS) 2. Treating metallic oxides [to obtain hydrocarbons] (Fr. pat. 658,752) 9.

REVERDIN, F., NOELTING, AND VAN DER KAM, E. J.: *Tabellarische Uebersicht der Naphtalinderivate*. I. Tabellen. II. Literatur. 2nd ed. The Hague; Martinus Nijhoff. Reviewed in *Chimie und industrie* 22, 218(1929).

Hydrogenating organic compounds. A. O. JAEGER (to Selden Co.). Brit. 306,803, Feb. 25, 1928. Catalysts such as those described in Brit. 304,640 (C. A. 23, 4709) for hydrogenating N compds. are used for hydrogenating other org. compds. such as aromatic or aliphatic hydrocarbons, alcs., acids, esters and oils. A H-contg. gas suitable for use in such processes is obtained by passing water gas through a molten or boiling alloy of Hg with Pb or Cd.

Catalytic organic reactions. A. O. JAEGER (to Selden Co.). Brit. 306,883, Feb. 27, 1928. In reactions such as esterifications, condensations such as that of acetaldehyde to aldol or crotonaldehyde, polymerizations, condensation of CO and NH_3 to produce HCN and conversion of water gas into H, the reacting vapors are passed through heat-exchanging elements (of an app. which is described) at least partly embedded in a catalyst layer and the vapor is passed in indirect heat-exchange relation with the catalyst; the flow is then reversed and the vapor passed in direct heat-exchange relation with the catalyst and with the incoming gas; then the vapor passes, after another reversal of flow, through the catalyst layer.

Catalytic reactions with organic compounds. A. O. JAEGER (to Selden Co.). Brit. 306,884, Feb. 27, 1928. A converter having double counter-current heat-exchangers embedded in the catalyst is used for dehydrogenations such as of alcs. to form ketones and aldehydes, dehydrations as productions of olefins from satd. alcs. and decarboxylations such as production of benzoic acid from a mixt. of phthalic acid anhydride and water vapor. An app. is described similar to that of Brit. 306,883 (cf. preceding abstr.)

Hydrocarbons. ANGLO-PERSIAN OIL Co. Fr. 658,348, July 13, 1928. Aromatic liquid hydrocarbons are obtained from gaseous hydrocarbons contg. paraffins by gradually heating a current of the gas to a temp. (e. g., 550°) below that at which the final decompn. of the paraffin would take place, and submitting the gas current afterwards to a temp. (e. g., 650 – 975°) at which the paraffins are decomposed and the vapors of aromatic hydrocarbons are formed, reducing quickly the speed of the gas and cooling it.

Purifying normally solid hydrocarbons such as naphthalene, etc. IRA H. DERBY and KENNETH R. DAVIS (Derby to Peter C. Reilly). U. S. 1,727,052, Sept. 3. The material, in molten condition, is atomized by a blast of inert gas such as air in order to effect fractional crystn. from the resulting mixt. An app. is described.

Aromatic hydrocarbons. ARNOLD IRINYI. Ger. 481,732, June 13, 1924. Aromatic hydrocarbons are prepd. from vaporized phenols by the action of H or other gaseous reducing agents at high temps. One of the reacting gases is heated to the required high temp. and then allowed to mix with the other.

Purifying aromatic hydrocarbons. ALPHONS O. JAEGER (to Selden Co.). U. S. 1,729,543, Sept. 24. See Fr. 636,485 (C. A. 23, 274).

Depolymerization of hydrocarbons. JEAN MERCIER. Fr. 659,872, Dec. 22, 1927. Construction of retorts used.

Esters. IMPERIAL CHEMICAL INDUSTRIES, LTD., W. GIBSON and J. B. PAYMAN. Brit. 307,137, Dec. 21, 1927. Reaction is effected between an aliphatic acid amide and an aliphatic or alicyclic alc. in the presence of an inorg. metallic salt such as ZnCl_2 , ZnSO_4 , HgCl_2 or zinc chloride ammonia. The NH_3 evolved may be recovered or used in the prepn. of formamide or acetamide by reaction, resp., with CO or ketene. Examples are given of the production of esters which may be prepd. by the process.

Mixed esters. PAUL F. H. SCHWING. Fr. 34,412, Oct. 3, 1927. Addn. to 650,100 (C. A. 23, 2986). The reaction indicated in the prior patent is applied for the prepn. of the carbonates of (1) phenylethyl and allyl, (2) cinnamyl and allyl, (3) linalyl and allyl, (4) geranyl and allyl, (5) rhodinyll and methyl, (6) cinnamyl and methyl, (7) phenylethyl and methyl, (8) di(phenylethyl), (9) phenylethyl and rhodinyll, (10) phenylethyl and cyclohexyl and the chlorocarbonate of phenylethyl.

Ethers of isothiouraeas. SCHERING-KAHLBAUM A.-G. Fr. 658,974, Aug. 13, 1928. Ethers of isothiouraeas are prepd. by the reaction of a mercaptan on a cyanamide or an acidulated soln. of Ca cyanamide. In this way S-ethylisothiouraea, N-ethyl-S-methylisothiouraea and N,N-dimethyl-S-methylisothiouraea are prepd.

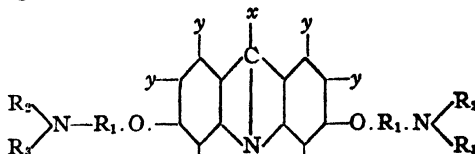
♦ **Diacetone ethers.** ALFRED HOFFMAN. U. S. 1,729,255, Sept. 24. In making diacetone ethers a primary alc. such as EtOH or BuOH is mixed with mesityl oxide in the presence of a strong acid, e. g., H_2SO_4 , and the ether formed is sep'd. after allowing the reaction mixt. to stand.

Diazo compounds from aromatic amines. KARL SCHIRMACHER and KONRAD RENN (to General Aniline Works). U. S. 1,728,217, Sept. 17. Difficultly diazotizable substituted compds. such as 2,5-dichloroaniline or 2,5-dichloro-4-toluidine are converted into sulfamic acids by reaction with chlorosulfonic acid or the like, in the presence of a tertiary org. base, and the sulfamic acids are treated with HNO_3 . Several examples are given.

Aminophenols. CHEMISCHE FABRIK GRÜNAU LANDSHOFF & MEYER A.-G. Brit. 306,939, Feb. 29, 1928. N-Methyl-p-aminophenols are prepd. by reducing the condensation product of the corresponding p-aminophenol and CH_2O with activated Al in alk. soln. The condensation and reduction may be effected in a single operation. Cf. C. A. 22, 1982.

Aminoalkyl and alkylaminoalkyl compounds. I. G. FARBENIND. A.-G. Brit. 307,305, March 2, 1928. Compds. of the general formula $R'R''N(CH_2)_nR'''$ in which R' and R'' indicate alkyl groups or H, R''' an aryl, hydroaromatic or heterocyclic residue (which may be substituted) and n is an integer, are prepd. by treating diethylaminoethyl chloride, methylaminoethyl chloride or other compds. of the general type formula $R'R''N(CH_2)_nX$ in which X is a halogen, with a Grignard reagent of the general formula $MgXR'''$. Various examples are given of the principal reaction and of the production of the Grignard reagents.

Dialkylaminoalkyl derivatives of 2,8-dihydroxyacridine. FRITZ MIETZSCH (to Winthrop Chemical Co.). U. S. 1,727,480, Sept. 10. New derivs. of 2,8-dihydroxyacridine having the general formula:



wherein x stands for H or alkyl, y for H, alkyl, alkoxy or any other univalent residue, and R_1 , R_2 and R_3 for alkyl residues, may be obtained in several ways, for instance, by causing the corresponding dihydroxy compd. to be acted upon by a haloalkylamine or to be acted upon at first by a halogenated alc. and converting then the hydroxyalkyl compds. thus obtained in a known manner into aminoalkyl ethers. These products are remedies against blood parasites. The free bases are oils or products of low m. p., difficultly sol. in water, easily sol. in ether, alc. or benzene. With mineral acids they form yellow hygroscopic salts, which dissolve in water with neutral reaction. Several examples are given.

Anthracene derivatives. I. G. FARBENIND. A.-G. Fr. 658,972, Aug. 13, 1928. Derivs. of the $C_{14}H_{10}$ series are prepd. by treating 1,2,3,4-tetrahydroanthraquinone or one of its homologs or substitution products with a nitrating agent. *ar*- α -Nitro-1,2,3,4-tetrahydroanthraquinone with a small amt. of the β -nitro compd. is obtained from 1,2,3,4-tetrahydroanthraquinone itself. The prepn. of 1,2,3,4-tetrahydro-8-nitro-7-methylantraquinone, m. 130° , and 1,2,3,4-tetrahydro-8-acetylamino-5-nitroanthraquinone, decomposing at 185° , is also described.

Anthraquinone derivatives. I. G. FARBENIND. A.-G. Fr. 659,962, Sept. 4, 1928. See Brit. 297,001 (C. A. 23, 2447).

Anthraquinone nitriles. KARL SCHIRMACHER and LUDWIG VAN ZÜTPHEN (to General Aniline Works). U. S. 1,728,216, Sept. 17. A halo anthraquinone is heated with a nitrile such as benzyl cyanide and cuprous cyanide.

Unsubstituted arylaminoanthraquinones. BRITISH DYESTUFFS CORP., LTD., and ARNOLD SHEPHERDSON. Ger. 481,617, Oct. 23, 1926. Unsubstituted arylaminoanthraquinones are prepd. by condensing an arylamine with a halogen-substituted anthraquinone in presence of enough $AcONa$ to act as a solvent or flux. Examples mention 1-amino-2-bromo-4-*p*-tolylaminoanthraquinone, 1-methylamino-4-*p*-tolylaminoanthraquinone and 1,5-di-*p*-tolylaminoanthraquinone.

Alkali xanthogenates. I. G. FARBENIND. A.-G. (Anton Schlachter, inventor). Ger. 481,996, Aug. 14, 1926. Alkali xanthogenates are recovered from aq. or aq.-alc. mother liquor by salting out with highly concd. aq. soln. of alkali hydroxide.

Substituted guanidines. SCHERING-KAHLBAUM A.-G. Fr. 659,004, Aug. 14, 1928. Substituted guanidines are prepd. by treating disubstituted cyanamide with a mixt. of an amine and an amine salt. Examples are given of the prepn. of *N,N*-diethyl-*N'*-phenylguanidine, *N,N*-diethyl (or dimethyl)-*N'*-isoamylguanidine and *N,N*-dimethyl-*N'*-ethylguanidine. Cf. C. A. 23, 1649.

Substituted guanidines. GEORGE BARSKY (to American Cyanamid Co.). U. S. 1,727,093, Sept. 3. Reaction between cyanogen chloride and an amine such as *o*-toluidine is effected in the presence of $PhCl$ or other org. solvent of the amine which is inert to the reacting substances. An arrangement of app. is described.

Hydroxythionaphthenes. I. G. FARBENIND. A.-G. Fr. 658,850, Aug. 9, 1928. 4-Methyl-6-*l*-alohydroxythionaphthenes are prepd. by substituting a CN group for the NH_2 group in 2-amino-3-nitro-5-halo-1-methylbenzenes, reducing to 2-cyano-3-amino-5-halo-1-methylbenzene, and substituting a SCH_2COOH for the NH_2 group therein and finally transforming the thioglycolic acid. An example is given of the prepn. of

5-chloro-2-cyano-1-methylbenzene-3-thioglycolic acid, which may be converted to the corresponding hydroxythionaphthene according to Fr. 366,611, Fr. 397,796 or Ger. 190,674.

Hydroxythionaphthenes. I. G. FARBENIND. A.-G. Fr. 659,073, Aug. 16, 1928. Hydroxythionaphthenes are prepd. by sapon. a cyanoaryl-*o*-thioglycolic acid in alk. soln. by the action of H_2O_2 to an *o*-thioglycolic acid of a corresponding arylcarboxylamide and transforming the latter by the final action of alkali. Examples are given of the prepn. of 6-ethoxyhydroxythionaphthene and 1-methylbenzene-5-chloro-3-thioglycol-2-carboxylamide, m. 172°. Cf. C. A. 23, 3477.

Lactones. GEORG SCHROETER and ALEXANDER GLUSCHKE. Fr. 659,119, Aug. 17, 1928. Alicyclic lactones of hydroaromatic polycyclic hydrocarbons are prepd. by condensing the alicyclic hydroaromatic halogenated α -acetones or their derivs. with malonic esters substituted by a metal, esters of α -cyanocarboxylic acid or esters of β -ketonecarboxylic acid, reducing the cycloketonyl derivs. obtained by sapon. and finally transforming, if necessary after treatment with an acid, the lactonecarboxylic esters or acids into lactones. Several examples are given.

Thiazoles. THE GOODYEAR TIRE & RUBBER CO. Fr. 658,734, Nov. 12, 1926. Thiazoles are obtained by the reaction of a compd. having a NO_2 group with a basic hydrosulfide, or an aq. soln. of a basic hydrosulfide in the presence of H_2S and CS_2 . An arylmercaptothiazole, a mercaptoarythiazole, a mercaptobenzothiazole or the 2-mercaptobenzothiazole are obtained by the reaction of the corresponding *o*-nitrohalo compd., di-*o*-dinitrodiaryl disulfide, di-*o*-dinitrodiphenyl disulfide, or *o*-nitrochlorobenzene with a soln. of a basic sulfide in the presence of H_2S and CS_2 , preferably at a high temp. and pressure.

Thiazole derivatives. I. G. FARBENIND. A.-G. Brit. 306,842, Feb. 24, 1928.

2-Mercaptoarylenethiazoles of the general formula $R \begin{array}{c} \diagup N \\ \diagdown S \end{array} C-SH$ in which R is an arylene residue (which may or may not be substituted) are prepd. by reaction on an *o*-aminoaryl sulfo cyanogen compd. with an alkali and a thiocarbonate of the general formula $S=C \begin{array}{c} \diagup S\text{-alkali metal} \\ \diagdown X \end{array}$ in which X represents O-alkali metal, S-alkali metal or O-alkyl. Several examples are given. Cf. C. A. 23, 4952.

Nuclear substitution products of 1-aminonaphthalene-8-carboxylic acid or its inner anhydride. RICHARD HERZ and FRITZ SCHULTE (to General Aniline Works). U. S. 1,728,995, Sept. 24. Nuclear derivs. of 8-cyanonaphthalene-1-sulfonic acid are obtained by diazotizing the corresponding nuclear substitution products of 8-aminonaphthalene-1-sulfonic acid and treating the diazo compds. thus formed with cuprous cyanide, by the Sandmeyer reaction. Nuclear derivs. thus obtained, which may be substituted as with halogen or addnl. sulfonic acid groups, are treated with an alk. reagent such as caustic alkalies or alk. earths in aq. or alc. soln. or suspension (suitably in an autoclave), and new sulfo-, hydroxy- and alkoxy-derivs. of 1-aminonaphthalene-8-carboxylic acid may be obtained (by processes the details of which are given in several examples) which may be used as *pharmaceutical compds.* or as *intermediates for manuf. of dyes*. Cf. C. A. 22, 2170.

Organic acids. STANDARD OIL DEVELOPMENT CO. Fr. 658,417, July 30, 1928. Org. acids of high b. p. are obtained from their mixts. with oils of high b. p. by converting the acids into alkali salts, dissolving the salts in water, sepg. the aq. from the oily layer, liberating the acids by adding a mineral acid, sepg. the free acids and re-converting them to the alkali salts, distg. under vacuum to remove traces of oil and reforming the acids. An app. is described.

Aromatic carboxylic acids. I. G. FARBENIND. A.-G. Brit. 307,223, March 21, 1928. CO_2 , with heat and pressure, is caused to act on aromatic hydrocarbons or their derivs. in the presence of Al halides. Benzoic acid contg. benzophenone is obtained from C_6H_6 in the presence of $AlCl_3$. *p*-Chlorobenzoic acid contg. some *p,p'*-dichlorobenzophenone is obtained from $PhCl$ in the presence of $AlBr_3$. *p*-Toluic acid contg. some *p,p'*-dimethylbenzophenone is obtained from toluene and $AlCl_3$. Xylic acids are similarly obtained from xylene, some tetramethylbenzophenone being present in the product.

Acetic acid. HERMANN SUIDA. Fr. 658,960, Aug. 13, 1928. Dil. AcOH is concd. by extrn. with ethers of phthalic acid such as the dibutyl or diethyl ether.

Benzoic acid. I. G. FARBENIND. A.-G. Brit. 307,343, March 5, 1928. Benzoic acid prepd. catalytically from phthalic acid or phthalic anhydride is purified (suitably

by treating with SO_2 or NaHSO_2 at $40-50^\circ$ for 3-4 hrs.) so that the naphthoquinone impurities are reduced to naphthohydroquinones while phthalic anhydride, if present, is converted to phthalic acid; the product is then leached with water or with an aq. soln. to remove the naphthohydroquinones and the phthalic acid.

Benzoic acid production and similar reactions. DAVID A. W. FAIRWEATHER, ERNEST G. BECKETT and JOHN THOMAS (to Selden Co.). U. S. 1,727,102, Sept. 3. In effecting exothermic reactions such as manuf. of benzoic acid from Ca phthalate and $\text{Ca}(\text{OH})_2$ a reaction mixt., at least one of the components of which is a solid, is passed through a narrow heated tube (suitably by the action of a screw conveyer) so proportioned that the surface of the tube takes up sufficient heat from the reacting mixt. to prevent undesirable decompn. or side reactions. Details of the app. are described. Cf. C. A. 23, 3478.

Sulfonic acids. I. G. FARBERIND. A.-G. (Karl Daimler and Gerhard Balle, inventors). Ger. 481,995, Mar. 19, 1926. Odorless and colorless sulfonic acids of butyl derivs. of aromatic hydrocarbons are prepd. by using synthetic BuOH which is free from paraldehyde. Thus, naphthalene and paraldehyde-free rectified BuOH are added to chlorosulfonic acid at $60-70^\circ$, stirred, neutralized with NaOH and dried, giving a white odorless powder which forms a colorless soln. Tetrahydronaphthalene, benzene, toluene, etc., may be used instead of naphthalene. Cf. C. A. 23, 4951.

α -Naphthylaminesulfonic acids. IVAN GUBELMANN and JOHN M. TINKER (to Newport Co.). U. S. 1,728,607, Sept. 17. NH_3 is added, as a neutralizing agent, to a dild. nitration mass contg. α -nitronaphthalenesulfonic acids and free inorg. acids and, without intermediate filtering, reduction is effected with Fe and acid.

Purifying phthalic anhydride. PAUL C. BOWERS (to E. I. Du Pont de Nemours & Co.). U. S. 1,728,225, Sept. 17. In order to remove impurities such as are formed in the catalytic vapor-phase oxidation of naphthalene, the impure phthalic anhydride is heated with a condensing agent such as ZnCl_2 or NaOH capable of rendering the impurities relatively less volatile than the phthalic anhydride, and the phthalic anhydride and assocd. impurities are sepd. by distn. or sublimation.

Xylenes. EDUARD TSCHUNKER and FRITZ REICHLER (to General Aniline Works). U. S. 1,727,682, Sept. 10. In the manuf. of *o*- and *p*-xylenes, toluene is treated with CH_2O in the presence of HCl and the resulting mixt. of *o*- and *p*-xylyl chlorides is reduced to the corresponding xylenes.

Arsenobenzene. I. G. FARBERIND. A.-G. (Louis Benda, inventor). Ger. 481,997, June 29, 1926. Arsenobenzene is prepd. by reducing 3-chloro-4-hydroxy-acylaminobenzene-*arsonic* acid. Thus, 3-chloro-4-hydroxyacetamidobenzene-1-*arsonic* acid is dissolved in MeOH, cooled and mixed with HCl. A little HI is added and the mixt. cooled to ppt. the arsenobenzene.

Methanol. GIULIO NATTA and MARIO FALDINI. Fr. 658,788, July 18, 1928. MeOH is obtained by passing a mixt. of CO and H at high pressure over a mixt. of FeO or CoO and oxides of other bivalent metals such as Mg, Mn, Cr, Zn, Be with or without small amts. of oxides of trivalent metals.

Phenylmethyaminopropanol. ERNEST FOURNEAU. Fr. 659,882, Dec. 23, 1927. Phenylmethyaminopropanol (ephedrine) is prepd. by reducing phenyl methylamino-ethyl ketone by H in the presence of finely divided Pt.

Formaldehyde. I. G. FARBERIND. A.-G. Fr. 659,797, Aug. 31, 1929. CH_2O is prepd. in the solid state by introducing alk. substances, e. g., Na_2CO_3 , into aq. solns. of CH_2O contg. little or no MeOH and cooling. Cf. C. A. 23, 3717.

Ethyl acetate. I. G. FARBERIND. A.-G. Brit. 307,471, March 8, 1928. In prepg. EtOAc from HOAc and EtOH by use of a strong acid as a catalyst, an excess of HOAc is maintained in the still during most of the process and strong EtOAc is returned from the condenser to the top of the distg. column to flow counter-current to the rising vapors; alc. is gradually added during the process and is added in excess at the end of the process to esterify all remaining HOAc. Various other details and modifications are described.

sec-Butyl acetate. HYM E. BUC and WOODMAN W. CLOUGH (to Standard Development Co.). U. S. 1,726,945, Sept. 3. A mixt. of *sec*-BuOH about 55%, strong HOAc about 45% and concd. H_2SO_4 about 0.1% is subjected to distn. and the distillate collected is allowed to stratify in layers; the upper layer is continuously refluxed and the refluxing is discontinued when stratification practically ceases and the still contents are distd. up to within a few points of the b. p. of *sec*-BuOAc, then further distd. up to $2-3^\circ$ of the b. p. of HOAc while separately collecting the distillate, water is added to the distillate to form a constant b. p. mixt. with the *sec*-BuOAc present, and the aq. *sec*-BuOAc is distd.

Diarylguanidine. I. G. FARBENIND. A.-G. (Helmuth Meis, inventor). Ger. 481,994, Aug. 27, 1926. Diarylguanidine is prepd. by treating diarylthiourea with alkali or alk. earth metals in presence of NH_3 and org. or inorg. Zn compds.

Diphenylguanidine. RALPH V. HEUSER (to American Cyanamid Co.). U. S. 1,727,060, Sept. 3. Cyanogen chloride is caused to react with PhNH_2 , and, after distn., to remove PhNH_2 from the product, the latter is treated with a sufficient quantity of a weak alkali such as Na_2CO_3 to ppt. the weak bases present but not the diphenylguanidine. An arrangement of app. is described.

Ditolylguanidine. JOHN YOUNG (to National Aniline & Chemical Co.). U. S. 1,727,916, Sept. 10. In making di-*o*-tolylguanidine hydrohalide, *o*-toluidine at a temp. of about 60–130° (suitably about 90–110°) is subjected to the action of cyanogen fluoride or chloride.

Polymethylene-*N,N'*-dialkyl(or diaryl)-diguandine. SCHERING-KAHLBAUM A.-G. Ger. 481,925, May 15, 1927. Addn. to 463,576 (*C. A.* 22, 4130). The above diguanidine derivs. are prepd. by the action of higher diamines on solns. of *N*-alkyl- or *N*-aryl-*S*-alkylisothioureia salts. Thus, *N*-phenyl-*S*-methylisothioureia-HCl or -HI is allowed to react with a concd. alc. soln. of decamethylenediamine at 60°. On distg. off the alc., decamethylene-*N,N'*-diphenyldiguandine, m. 143–144°, is obtained. Another example mentions decamethylene-*N,N'*-dimethyldiguandine, m. 140–142°.

Hexahydroaniline. I. G. FARBENIND. A.-G. (Wilhelm Lommel and Theodor Goost, inventors). Ger. 481,984, Nov. 27, 1926. See Can. 283,752 (*C. A.* 22, 4540).

6-Alkoxy-8-aminoquinolines. WERNER SCHULEMANN, FRITZ SCHÖNHÖFER and AUGUST WINGLER (to Winthrop Chemical Co.). U. S. 1,728,189, Sept. 17. 6-Alkoxyquinoline-8-carboxylic acid esters are subjected to the Curtius reaction by treating them with hydrazine hydrate to form the hydrazides, the latter are treated with nitrous acid to form the azides, and the azides are treated with an alc. to obtain the urethans, and the urethans are treated with a saponifying agent such as $\text{Ca}(\text{OH})_2$ to obtain the amines. Cf. *C. A.* 23, 1995.

1,4-Dichlorophthalazine. I. G. FARBENIND. A.-G. (Arthur Wolfram, inventor). Ger. 481,650, July 17, 1925. 1,4-Dichlorophthalazine and its substitution products are prepd. by treating 1,4-dihydroxyphthalazine or its substitution products with chlorinating agents such as POCl_3 .

Divinyl. I. G. FARBENIND. A.-G. Fr. 659,314, June 7, 1928. Divinyl and its homologs are prepd. by passing 1,3-butyleneglycol or its homologs in vapor form and preferably mixed with dilg. gases or vapors over acid salts or salts having an acid action, at a high temp. Examples are given of the prepn. of 1,3-butadiene and α,α -dimethylbutadiene with alum or a mixt. of phosphates of Ca and Na as catalysts.

Condensation of dimethylolurea or dimethylolthiourea. I. G. FARBENIND. A.-G. Brit. 306,875, Aug. 27, 1927. Condensation is effected by heating for a short time in aq. soln. or suspension contg. a buffer substance (such as a mixt. of primary and secondary Na phosphates) which maintain the p_H at a practically constant value between 4 and 7.

11—BIOLOGICAL CHEMISTRY

PAUL E. HOWE

A—GENERAL

FRANK P. UNDERHILL

Physical chemistry in the service of biology. First Liverside Lecture. FREDERICK G. DONNAN. *J. Chem. Soc.* 1929, 1387–98.—The services of org. and inorg. chemistry to biology are also considered. J. BALOZIAN

Relation of the viscosity of blood serum to temperature and the hydration of the proteins. P. LÉCOMTE DU NOÛY. *Ann. inst. Pasteur* 42, 742–69(1928); cf. *C. A.* 22, 3181.—The viscosity of the blood serum of rabbits is least at 57°. Heating for 1 hr. at 55° does not increase the viscosity, but heating above 56° causes an irreversible increase. Under these conditions the viscosity may be increased three-fold, and by an application of the principles of Einstein (*C. A.* 5, 2995) to the results, the degree of hydration of the protein micelles may be calcd. B. C. A.

The viscosity of blood serum as a function of temperature. P. LÉCOMTE DU NOÛY. *J. Gen. Physiol.* 12, 363–77(1929); cf. preceding abstr.—By means of a viscometer devised by du N. (*C. A.* 17, 1738) continuous readings of the variation of vis-

cosity of blood serum as influenced by temp. have been made. The curves expressing viscosity as a function of temp. show between 56° and 57° a critical point at which the viscosity reaches a min. value. The lowest temp. at which an irreversible change affecting viscosity occurs in the blood serum is 56°. Einstein (*Ann. Physik* 19, 289 (1906)) states that viscosity is expressed as a linear function of the vol. occupied by the dispersed substance, the size of the mols. or particles being immaterial. His equations expressing this relation fail to fit the exptl. facts obtained from these expts., however, for reasons that are not clear. An empirical formula proposed by Kunitz (*C. A.* 20, 3616) fits the exptl. data but then the role of the degree of dispersion which is a consequence of Einstein's math. derivations may no longer hold. It is therefore impossible at present to decide whether figures computed from these formulas express quantitatively the increase in viscosity due to hydration or whether other phenomena are involved. Figures expressing hydration obtained by the Einstein formula are 3.71 times larger than those obtained from Kunitz's formula. Serum behaves like a true soln. up to 55°. It has a very low viscosity for a soln. with such a high concn. of protein.

C. H. RICHARDSON

The existence of neoglucose. A. RONCATO. *Boll. soc. ital. biol. spec.* 3, 1348-9(1928).—The existence of neoglucose, a supposed labile form of glucose, has been doubted lately. R. concd. blood to $1/10$ its vol. by blowing a current of air over it, the temp. never rising over 10°, in order to prevent change to the more stable glucose, and then measured the rotation of the concentrate. The value found has always been close to $[\alpha]_D = 52.5^\circ$, the value for glucose, rendering improbable the presence of a different form, at least in analyzable quantities.

A. W. CONTIERI

Urochromogen. II. Preparation and determination. E. SCHUNTERMANN AND F. K. HOFFMANN. *Beitr. Klin. Tuberk.* 69, 438-43(1928); *cf. C. A.* 22, 970.—Urochrome is considered the oxidation product of urochromogen. Urochrome is prepd. by adding a small quantity of Na perborate (Merck) to concd. NH_4OH -free H_2SO_4 , which after cooling is added to 2 cc. of cool urine; temps. in excess of 50° are avoided and the mixt. is shaken with 3 cc. of ether. The ethereal ext., yellow in color, contains the dissolved urochrome. Pure urochrome seps. as needles which are sol. in ether, alc. and petr. ether, as well as in mineral and org. acids, but are only slightly sol. in H_2O . The ethereal soln. of urochrome treated with 10 parts of NH_4OH changes to a brown color which is either the NH_4 salt of urochrome or a uromelanin, the latter conception being preferred. A method for detg. urochrome in the Autenrieth colorimeter is described. Urochrome, like uromelanin, is an aromatic nucleus with a mol. S component.

H. J. C.

Further studies on the nature of the proteases underlying the Abderhalden reaction. EMIL ABDERHALDEN. *Fermentforschung* 11, 1-21(1929).—The enzymes present in gravid serum are sensitive not only to high but also to low temps. Cooling to 0° can destroy their activity. Eluates prepd. from dried serum show the same behavior in this respect as fresh serum. Dried serum, on the other hand, can withstand chilling 1 hr. at -10° without loss of activity. Proteases extd. from dry placenta show a similar behavior toward warming and cooling as the serum enzymes. From this it is inferred that the plasma or serum proteases occurring during pregnancy originate in all probability in the placenta. The connective tissue of placenta is not affected by gravid serum, the proteins subject to degradation belonging to the placenta stroma. The enzymes which occur in the blood plasma during pregnancy are excreted through the kidneys. If gravid serum is evapd. to dryness at a low temp. an active ext. can be obtained from the dry residue by means of concd. glycerol. Enzymes which may be adsorbed from this ext. by means of $\text{Al}(\text{OH})_3$ and recovered by elution show a specific action toward placenta substrate. These expts. are to be extended to other cases, such as carcinoma, to det. whether pos. Abderhalden reaction may be obtained with both serum and urine.

A. W. DOX

Sugar binding and related synthetic processes of yeast cells. ERNST WERTHEIMER. *Fermentforschung* 11, 22-36(1929).—Glucose added in small quantity to a yeast suspension disappears rapidly before fermentation sets in. This is not due to adsorption by the suspended particles, since the rate of disappearance varies with the temp. Between 0° and 15° the temp. quotient is 2; between 15° and 35° it is 4-8. The phosphate content of the soln. is without influence, and a simultaneous binding of H_3PO_4 and glucose does not occur. A portion ($1/7-1/2$) of the sugar can be recovered as a polysaccharide which is insol. in 60% KOH and is therefore not glycogen. When the insol. polysaccharide is boiled with very dil. acid a substance is split off which has all the properties of glycogen. Fructose and sucrose disappear from yeast suspension in the same manner and yield the same product. Galactose, lactose, maltose, dihydroxyacetone and other non-fermentable sugars do not undergo this disappearance

and synthesis to a polysaccharide. In general only those sugars undergo polysaccharide synthesis which are fermentable. Typical poisons, such as fluorides, which suppress fermentation also inhibit the synthesis. Other poisons, such as KCN, which do not inhibit fermentation are without influence. Yeast varieties which give the most rapid fermentation of sugar synthesize this polysaccharide the most rapidly. Two apparent anomalies are the fact that AcCO_2H which slowly ferments does not undergo this synthesis, and that maceration juice which ferments sugar is incapable of synthesizing the polysaccharide. A. W. Dox

Studies on the influence of various alcohols in various concentrations on the rate of hydrolysis of protein and polypeptides by proteases or the trypsin-kinase and erepsin complex. EMIL ABDERHALDEN AND FRITZ REICH. *Fermentforschung* 11, 64-77 (1929).—The influence of alcs. in different concns. on the digestion *in vitro* of *dl*-leucylglycine by erepsin at p_H 7.8, *dl*-leucylglycyl-*dl*-leucine by trypsin-kinase at p_H 8.4, and casein in 0.1 N HCl by gastric juice was detd. by the Willstätter titration method. Tryptic digestion was promoted by hexyl alc.; it was inhibited by AmOH, BuOH, Me_3COH , iso-AmOH and PhCH_2OH ; and it was promoted by low and inhibited by higher concns. of MeOH, EtOH, PrOH, iso-PrOH and iso-BuOH. Ereptic digestion was promoted by Me_3COH ; it was inhibited by PrOH, hexyl alc., Me_3CHOH , iso-BuOH, PhCH_2OH ; and it was promoted by low and inhibited by higher concns. of MeOH, BuOH, iso-AmOH, EtOH. Peptic digestion was inhibited by MeOH, EtOH, BuOH, iso-AmOH; it was promoted by low and inhibited by higher concns. of PrOH, AmOH, hexyl alc., Me_3CHOH , Me_3COH , iso-BuOH, PhCH_2OH . AmOH, heptyl alc. and octyl alc. were without influence on erepsin. These observations have no direct application to the corresponding enzymic processes in the living organism. A. W. D.

The cell enzymes present in organs and specific for protein and protein cleavage products. EMIL ABDERHALDEN AND OSKAR HERMANN. *Fermentforschung* 11, 78-85 (1929).—An attempt was made to det. the nature of the tissue enzymes responsible for autolysis. Liver and kidney tissues were dehydrated with MeAc and the dry powder was extd. with 87% glycerol. The crude ext. showed much greater activity toward free polypeptides than toward their PhNCO , Bz and $\beta\text{-C}_{10}\text{H}_7\text{SO}_2$ derivs. By the Willstätter adsorption method the press juice from fresh organs, after removal of proteins by acidifying and centrifuging, was brought to p_H 4.7 and treated with $\text{Al}(\text{OH})_3$, and the centrifuged adsorbate extd. with phosphate buffer of p_H 8.4. Sep. detns. were made of the activity of the adsorbate, the unadsorbed enzyme, and the eluate from the adsorbate, with di- and tri-peptides and some of their PhNCO , $\beta\text{-C}_{10}\text{H}_7\text{SO}_2$ and halogenacyl derivs. as substrates. The relative activity toward different substrates varied with the different enzyme fractions tested, indicating a partial sepn. of enzymes from a complex mixt. The hydrolysis, *e. g.*, of *dl*-leucylglycyl-*dl*-leucine and of *dl*- α -aminobutyrylglycine, in % in CONH linkages ruptured, by liver adsorbate was 48 and 0; by liver eluate 43 and 32. With kidney adsorbate the values were 21 and 57; with kidney eluate, 47 and 20. Other substrates showed a similar reversal of relative susceptibility to hydrolysis after elution of the enzyme adsorbate. The optimum p_H for hydrolysis of the polypeptides was 7.1, while that for the halogenacyl derivs. was 8.4, a further evidence of the action of sep. enzymes. Eluates obtained at p_H 8.4 were in general more active than those obtained at p_H 7.1. A. W. Dox

Comparative investigations on the enzymic breakdown of some proteins by the action of pepsin, trypsin-kinase and erepsin in varying sequence. EMIL ABDERHALDEN AND ERNST SCHWAB. *Fermentforschung* 11, 92-103 (1929).—The 4 substrates, casein, fibrin, edestin and gelatin, were subjected to the action of enzymes in varying sequence, the extent of digestion by each enzyme being detd. by the Willstätter titration method. With casein the hydrolysis proceeded further when the action of pepsin or trypsin-kinase was followed by that of erepsin. After digestion by trypsin-kinase and erepsin, casein showed no further hydrolysis by pepsin, but after peptic and ereptic digestion a further cleavage was produced by trypsin-kinase. Fibrin, on the other hand, was still capable of peptic digestion after successive treatment with trypsin-kinase and erepsin, but not of tryptic digestion after treatment with pepsin and erepsin. The total hydrolysis was considerably greater in the first of these 2 sequences. Edestin showed greater hydrolysis by trypsin-kinase and erepsin than by pepsin and erepsin in the order named. The same was true of gelatin, but here the total hydrolysis was considerably less in both instances. In no case did the hydrolysis of any substrate by 2 or 3 enzymes, regardless of sequence, approximate that obtained by 25% H_2SO_4 or 20% NaOH. This is probably because the purified trypsin and erepsin used had been freed from other enzyme present in the natural secretions. It is apparent that pepsin and trypsin-kinase attack the protein in different manner, although both yield

cleavage products amenable to ereptic digestion. The possibility remains, however, that each enzyme prepn. may contain substances which promote or inhibit the action of the enzyme used subsequently in the sequence. A. W. Dox

The problem of the separation of erepsin and trypsin or trypsin-kinase into fractions with specific action. EMIL ABDERHALDEN AND ADOLF SCHMITZ. *Fermentforschung* 11, 104-18(1929).—To det. whether purified erepsin represents an individual enzyme or a mixt., 3 erepsin prepn. were examd. with respect to their relative activity toward isomeric peptides. One prepn. was tested with the 6 isomeric tetrapeptides composed of 2 units each of glycine and *dl*-leucine. The isomers were *glycyl-dl-leucyl-dl-leucylglycine* (I), m. 228°, *dl-leucylglycylglycyl-dl-leucine* (II), *dl-leucyl-dl-leucylglycylglycine* (III), *glycylglycyl-dl-leucyl-dl-leucine* (IV), m. 233°, *glycyl-dl-leucylglycyl-dl-leucine* (V), and *dl-leucylglycyl-dl-leucylglycine* (VI). I and IV are new peptides which were obtained by coupling the next lower tripeptide with ClCH_2COC and aminating the intermediate chloroacetyl deriv. by means of 25% NH_4OH at 37°. Erepsin I, which was active toward *dl-leucylglycine*, hydrolyzed all the tetrapeptides though not to the same extent. After 5 days it lost its activity toward *dl-leucylglycine*, but had retained its activity toward V and VI after 17 days. Erepsin II was inert toward the dipeptides *dl-leucylglycine*, *dl-leucyl-dl-leucine* and *glycylglycine*, but active toward *glycyl-dl-leucine*, especially at p_{H} 7.1. It hydrolyzed *glycyl-l-tyrosine*, *dl-leucylglycyl-dl-leucine*, *glycyl-dl-leucylglycine* and the pentapeptide *dl-leucylglycyl-dl-leucylglycyl-dl-leucine*, also the tetrapeptides V and VI, but not III and IV. Erepsin III was inert toward *dl-leucylglycine* and *glycylglycine* but active toward the tripeptides *dl-leucylglycylglycine* and *glycyl-dl-leucylglycine*. It was not tested with respect to the tetrapeptides. A significant observation is the fact that erepsin I, after loss of activity toward *dl-leucylglycine*, changed its p_{H} optimum towards V and VI from 9.3 to 7.1. In general it appears improbable that di-, tri-, tetra- and pentapeptides are hydrolyzed by sep. enzymes, since different peptides contg. the same no. of units show greater differences toward a given enzyme complex than peptides with different nos. of units. A. W. Dox

The nature of protease. III. Parallelism between the activity of pepsin preparations determined by disappearance of the substrate and by increase in carboxyl groups. A. N. ADOVA AND I. A. SMORODINTZEV. *Z. physiol. Chem.* 183, 133-48(1929); cf. *C. A.* 23, 2994.—Five pepsin prepn. arranged in the order of decreasing activity as detd. by the rate of disappearance of substrate, show the same relative activity when the detns. are made by titration of liberated COOH groups. This holds true whether the substrate is casein or gelatin. Comparisons of peptic activity by methods based on disappearance of substrate (methods of Gross, Fuld-Levissohn, Mett) thus give the same results as those by the method of volumetric detn. of cleavage products (method of Willstätter). When pepsin is added to the casein soln. the p_{H} is always displaced toward the alk. side, but this effect is much greater with highly active than with less active prepn. With initial adjustment to uniform p_{H} , the same effect is observed during the course of digestion, the more active enzymes causing the greater displacement. For optimum digestion gelatin requires a higher acidity than casein. As with casein, so with gelatin, the initial displacement of p_{H} toward alky. varies with the activity of the enzyme. During digestion, however, the p_{H} decreases slightly, but increases slightly if thymol has been added. In contrast to that of casein the velocity const. of gelatin digestion for equal substrate quantity and equal duration is somewhat lower. It follows the Schutz-Borissow law only in active prepn., the least active prepn. showing a linear relationship. Peptic digestion of casein and gelatin does not liberate amino acids, the titratable COOH groups formed being present in peptides. In general casein is digested more energetically than gelatin. A. W. D.

The kinetics of ester hydrolysis by enzymes. I. EUGEN BAMANN AND MARIA SCHMELLER. *Z. physiol. Chem.* 183, 149-67(1929).—Esterase prepn. were obtained from the livers of various animals (sheep, dog, man, rabbit, horse, steer) by extn. of the powd. organ with NH_4OH , pptn. by AcOH and dialysis. These were compared with respect to the influence of substrate concn. and H-ion concn. on the hydrolysis of $\text{Pr-CO}_2\text{Me}$. It has been assumed that liver esterase, because of its especial activity toward simple fatty acid esters, possessed a high affinity for these substrates, while the pancreatic enzyme, with greater activity toward high mol. glycerides, possessed a low affinity for simple esters. It is now shown that the liver enzyme varies considerably in its affinity for esters of lower fatty acids, and these variations may be as great as those between hepatic esterase and pancreatic lipase. The p_{H} optimum of hepatic esterase from different animals is subject to variations, as is the case with gastric lipase. The range is between p_{H} 7 and 9, but the decrease in activity on either side of the op-

timum is not great within these limits. In acid medium both cleavage products of the ester decrease the reaction velocity, but in alk. medium only the alc. is of influence. The reaction is linear up to the higher degrees of cleavage for enzymes which show considerable affinity for the substrate but little for the cleavage products. As long as the substrate can completely bind the enzyme, equal reaction occurs in equal times. Deviations from the linear course are found in a rise in the reaction curve when the velocity increases during the reaction, and in a drop in the curve when the ester cleavage is brought about by an enzyme of low affinity. A monomol. reaction is only the extreme case. With enzymes of high substrate affinity, *e. g.*, human hepatic esterase, a drop in the linear course is observed when the enzyme, not sufficiently stabilized by protective substances, undergoes partial destruction. Enzymes from steer, dog and sheep liver are entirely stable; that from human liver, on the other hand, has little stability.

A. W. DOX

Desaminocasein. H. STEUDEL AND R. SCHUMANN. *Z. physiol. Chem.* 183, 168-76 (1929).—Desaminocasein prepd. by the action of HNO_2 on casein according to the procedure of Dunn and Lewis (*C. A.* 16, 569) was subjected to hydrolysis and the amts. of individual amino acids thus obtained were compared with those resulting from hydrolysis of the original casein. The most striking differences were the total absence of lysine, the partial loss of histidine and arginine, and the increase in cystine as detd. by the Folin method. Tyrosine and tryptophan remained unaltered. Desaminocasein has all the properties of a protein and cannot be regarded as a mixt. of smaller fragments. If casein consisted of simpler mols. held together by secondary valences the action of HNO_2 could certainly be expected to disrupt such unions. Its failure to do so is construed as evidence against the secondary valence theory as applied to the protein mol.

A. W. DOX

The chemistry of water and the distribution of the plankton organisms. WALTER RAMMNER. *Naturw. Umschau Chem.-Ztg.* 18, 54-7 (1929).—A general discussion, more biol. than chem.

RUSSELL C. ERB

The chemistry of bile acids. HEINRICH WIELAND. *Z. angew. Chem.* 42, 421-4 (1929); cf. *C. A.* 21, 590, 2905; 22, 3415.—The author's Nobel Lecture given in Stockholm, Dec., 1928, in which he reviews his work on this subject. FREDERICK C. HAHN

New research on cozymase. HANS VON EULER AND KARL MYRBÄCK. *Naturwissenschaften* 17, 291-3 (1929); cf. *C. A.* 22, 4541, 4542.—Several points in properties and isolation of the cozymase product of the authors are discussed (cf. *C. A.* 23, 2453). The product is purified by pptn. with $\text{Pb}(\text{OAc})_2$, $\text{Hg}(\text{OAc})_2$ and phosphotungstic acid, then fractionated with picric acid, and further purified with AgNO_3 , NH_3 and H_2S , and finally pptd. by acetone. The preps. had purities of 70,000 to 80,000 units. The N content was from 14.5 to 15%, probably solely adenine, which indicates a mol. wt. of 470; from diffusion expts. 486 was found for cozymase. A N-free part of the mol. is present of mol. wt. 350; it gives the phloroglucinol reaction, but contains little furfurole. Phosphoric acid seems to be an essential constituent (7% P). The substance is probably a special adenine nucleotide, not, however, adenylic acid. The thermo-inactivation of the substance does not run parallel with PO_4 liberation. Several other properties are discussed.

B. J. C. VAN DER HOEVEN

Enzymic inactivation of cozymase. HANS VON EULER, KARL MYRBÄCK AND EDVARD BRUNNUS. *Z. physiol. Chem.* 183, 60-6 (1929).—The inactivation of cozymase by ricinus preps. led Buchner and Klatte (*C. A.* 2, 2568) to the conclusion that cozymase is an ester. This view is now shown to be erroneous. Cozymase is not inactivated by esterase from adipose tissue, nor by the lipase present in pancreatic ext., nor by certain preps. of ricinus which are very active toward olive oil. On the other hand, ricinus preps. obtained by dehydration with EtOH and Et_2O and no longer active toward olive oil retain the power of inactivating cozymase. Control expts. showed that the effect was not due to inhibitory substances present. Enzyme preps. from other tissues, *e. g.*, liver, stomach, pancreas and intestine, obtained by means of MeAc and Et_2O , or by glycerol extn., inactivate cozymase. The inactivation is accompanied by a splitting off of H_3PO_4 . Euler and Myrbäck (cf. preceding abstr.) recently showed that purified cozymase contains adenine, carbohydrate and P, suggestive of a nucleotide structure. Raymond's observation (*C. A.* 23, 161) that cozymase is extd. from living American yeast by H_2O contg. PhMe could not be confirmed with Swedish yeast. Instead, there was a destruction of cozymase, not noticeable during the first 7 hrs. but very pronounced in 25 hrs.

A. W. DOX

Studies on the origin of creatine. The enzyme nature of the processes of the Abderhalden reaction; studies on the nature of enzyme action. EMIL ABDERHALDEN. *Naturwissenschaften* 17, 293-4 (1929).—By adsorption and elution methods there could

be isolated from a glycerol soln. of dried serum from pregnant women enzymes which hydrolyzed placenta protein specifically. This concn. method was used for the sensitization of the Abderhalden reaction; similar enzymes were found in cerebrospinal fluid and in urine of pregnant persons. Expts. on substitution of org. groups (phenylcarbonyl and β -naphthalenesulfonyl) in polypeptides led to the conclusion that enzyme action consists of the formation of an enzyme-substrate compd. at an optimum p_H with consequent alteration of the substrate in such a manner that a previously inactive H-ion concn. now is enabled to split up the substrate. B. J. C. VAN DER HOEVEN

The structure of proteins. M. BERGMANN. *Naturwissenschaften* 17, 314-6' (1929).—Besides amide bonds it has frequently been proposed that protein contains anhydride bonds between peptides. *d*-Phenylalanyl-*d*-arginine anhydride in pure form (not as salt) shows rapid autoracemization. The process follows $\alpha_t = \alpha_0 e^{-kt}$ with $k = 0.0357$, t in min. In 20 min. α decreases to $1/2 \alpha_0$. The hydrolysis of the diketopiperazine is much slower (several days). *d*-Phenylalanyl-*d*-arginine does not show autoracemization, which indicates that for this process a free guanido group of the arginine is required and a ring system in the rest of the molecule. Similar autoracemization is observed on *d*-bisguanidovaleric acid anhydride ($k = 0.036$). The effect is a means for testing the manner of combination of arginine in protein mols. In clupein, in which the guanido groups of the arginine are free, no autoracemization is found, thus excluding anhydride ring structure for this protamine and indicating open peptide structure. B. J. C. VAN DER HOEVEN

Experiments on insulin. KARL FREUDENBERG. *Naturwissenschaften* 17, 603-4 (1929).—Acetylinsulin deacetylated by alkali is less stable towards dil. alkali than insulin; the regenerated substance is apparently an insulin deriv. perhaps partly acetylated. More sensitive than insulin is an amorphous prepn. of high activity which can be made from the technical insulin by hot 0.1 *N* HCl + 1% NaCl. Of the total activity remaining 80% is in the coagulate; 5 to 10% in the mother liquor. Similar results were obtained with cryst. insulin (cf. du Vigneaud, *C. A.* 22, 4653). As regards the S content, at 0° in 2 days with *N*/30 alkali 1 to 2% of the total S (0.05% of the insulin) can be removed without change in activity; at 34° in 1.5 hrs. at the same dilution $1/4$ of the activity disappears; there is no change in S content. It is believed that S, particularly the labile S, is not incorporated in the actual insulin mol. No relation between optical rotation and S content was found. Between optical rotation and insulin action there is, however, a direct relation. The insulin absorption spectrum has a band at 2700 A. U. Insulin preps. of increasing activity contain increasing amts. of Me groups removable by HI (up to 0.7%), which simultaneously splits off the S; perhaps this can be considered due to thiomethyl groups. B. J. C. VAN DER HOEVEN

The proteolytic enzymes in malt. H. LÜERS AND L. MALSCH. *Wochschr. Brau.* 46, 265-9, 275-80 (1929).—The presence of a protease in aq. green malt infusions is established. The p_H optimum of this enzyme is 4.9-5.0 on a gelatin substrate. Its activity upon gelatin is increased nearly 50% in presence of HCN. The p_H optimum of the activated enzyme is 4.6-4.7. There was found also a peptidase acting upon leucylglycine at an optimum of p_H 7.5. Proportionality was found between digestion and quantity of enzyme, and digestion and time, resp. For the selective adsorption of both enzymes "Clay A" was found to be the best. The p_H optimum of the adsorption is 5. More protease is adsorbed on a given quantity of clay than peptidase, even in a 20% alk. soln. Both enzymes can be elutriated with Na_2HPO_4 . The protease was leached out in certain cases with water. If the first adsorption is submitted to a further fractionated adsorption and elution it yields an enzyme soln. contg. 12.6% of the original quantity of peptidase and 53.8% of the original quantity of the protease. Compared with the original malt infusion the protease content of the elution thus obtained will be 4.5 times larger than its peptidase content. The peptidase is easily destroyed below p_H 5. Both enzymes are sensitive to alc., the protease to small quantities. S. JOZSA

Sulfur-containing amino acids. VIII. The quantity of cysteine in the fresh tissue proteins. YUZURU OKUDA AND YOSHITARO KATAI. *J. Agr. Chem. Soc. Japan* 3, 549-60 (1929).—Tissue proteins, which were pptd. with sulfosalicylic acid from the fresh tissue, were hydrolyzed with HCl in a current of CO_2 gas. Cysteine was detd. by means of KI-KIO₃ with $CHCl_3$ as indicator in place of starch soln. Over 90% of the S-contg. amino acids was found to be cysteine in the muscle proteins, freshly prepd. of hen, carp, eel, spiny lobster, etc. Liver protein also gave more cysteine than cystine. Hair and wool gave only a minute quantity of cysteine, and in egg albumin the cystine content is greater than the cysteine. K. KAMBE

Studies on the castor-bean lipase. IV. Influences of manganese sulfate, mag-

nesium sulfate and alanine upon the enzyme action. ETSUO TAKAMIYA. *J. Agr. Chem. Soc. Japan* 5, 595-600(1929); *Bull. Agr. Chem. Soc. Japan* 5, 23-4(1929).—Since Mn and Mg salts in EtOH soln. react acid toward phenolphthalein (cf. C. A. 22, 1115), T. titrated the fatty acid produced by the castor-bean lipase with rosolic acid as indicator. $MnSO_4$ and $MgSO_4$ had almost no influence but alanine retarded the enzyme action somewhat. Both crude and highly purified enzymes were employed in this study. K. KAMBE

Hydrogen-ion concentration of protoplasm. ROBERT CHAMBERS. *Natl. Research Council Bull.* 69, 37-47(1929); cf. C. A. 23, 2193.—A review. W. D. LANGLEY

Action of sea water in small quantities on fermentation. CHARLES RICHEL AND MICHEL FAGUET. *Compt. rend.* 189, 219-221(1929).—Comparisons are made of the increase in acidity of a lactose broth inoculated with a lactic acid enzyme and a similar broth to which either water from the Mediterranean Sea, or an artificial sea water, is added. An av. of about 50 tests on several concns. of each type shows: (1) a retardation in concns. of 50 pt. of sea water per 100, (2) an acceleration in concns. of 10^{-4} pt. per 100, (3) a secondary retardation in concns. of 10^{-8} pt. per 100. (4) a secondary acceleration in concns. of 10^{-10} pt. per 100. A similar retardation followed by an acceleration was found by Richet for small concns. of pure salts. This was explained by a toxic effect of the higher concn. and a stimulating effect of the lower concn. The secondary retardation and acceleration may be due to greater ionization in very dil. solns. or to the presence of other salts in concns. too low to have been detected. AMY LEVESCONTE

The oxidation-reduction potential of mammalian tissues. ERNST A. H. FRIEDHEIM. *Compt. rend.* 189, 266-8(1929).—Detns. of E_A and r_H of mammals are made with Hg electrodes under aseptic conditions. In the guinea pig, rabbit and pig the E_A values of the organs differ, but in each case the liver shows the highest value, from 0.327 to 0.344, and the spleen the lowest value, from 0.110 to 0.179. Cancerous tissue has no less reducing power than normal tissue. The F_A values decrease in arithmetical progression as the pulp is diluted in geometrical progression, which tends to lessen differences in the F_A in high dilution. The potential of the electrodes, after remaining const. for a time, constantly diminishes, even in the absence of O. Aseptic autolysis of muscle increases the E_A because of hydrolysis of glycogen. AMY LEVESCONTE

The separation of cystine from histidine: the basic amino acids of human hair. HUBERT B. VICKERY and CHARLES S. LEAVENWORTH. *J. Biol. Chem.* 83, 523-34(1929).—Cystine is almost completely pptd. as a Ag compd. at p_H 6 so that it may be expected to occur in the crude histidine fractions secured from proteins in the usual way. Cystine Cu is very insol. and seps. readily and completely when a soln. of cystine is boiled with an excess of $Cu(OH)_2$ and cooled. Histidine fractions can, therefore, be freed from cystine by proper treatments with $Cu(OH)_2$ and this manipulation contributes materially to the ease and accuracy with which histidine can subsequently be detd. as dinitronaphtholsulfonate in such fractions. When analyzed according to this procedure human hair contains 0.5% of histidine, 8.0% of arginine and 2.5% of lysine; colorimetric detn. of cystine on the same sample showed 16.5% to be present. A. P. L.

Further findings on invertase from honey. PHILLIPPOS E. PAPADAKIS. *J. Biol. Chem.* 83, 561-8(1929); cf. C. A. 18, 3603; 19, 835.—The hydrolysis of sucrose by honey invertase is not activated by the pentoses, mutarotated xylose, and *d*- or *l*-arabinose. The rate is not appreciably retarded by $HgCl_2$ at p_H 5.7 but is slowed up as the p_H decreases from 5.7 to 4.23. The influence of β -glucose is independent of the presence of $HgCl_2$. In the presence of α -methylglucoside β -glucose accelerates sucrose hydrolysis. The glucoside itself has very little retarding effect and does not change the shape of the curve when the p_H is varied between 5.84 and 4.2. A. P. LOTHROP

The influence of formalin fixation on the lipoids of the central nervous system. ARTHUR WHIL. *J. Biol. Chem.* 83, 601-9(1929).—In a 10% soln. of HCHO the phosphatides of the central nervous system are hydrolyzed and the liberated H_3PO_4 is found in a H_2O -sol compn. in the fixing fluid. The decompn. process is gradual and is still proceeding 90 days after fixation. The resulting mixt. of lipoids contains more galactolipides than the original tissues since cholesterol and the galactolipides are not appreciably affected by the HCHO. The preservation and relative increase of galactolipides explain certain empirically known histological facts; namely, the effect of pyridine in Ag staining methods of nerve fibers and the staining and phys. qualities of areas of so-called "mucoid degeneration" which are found in formalin material after alc. treatment. The present opinion that HCHO solns. are a fixative for the preservation of lipoids must, therefore, be revised. A. P. LOTHROP

Comment on the work of D. Keilin. OTTO WARBURG. *Biochem. Z.* 207, 494-5(1929); cf. C. A. 23, 3719.—Chiefly polemical. Keilin's proposal to designate the

respiratory enzyme "indophenoloxidase" is criticized because of the implication that indophenol is the principal product of oxidation by living matter. S. MORGULIS

Glyceric acid-monophosphoric acid. MARTHE VOGT. *Biochem. Z.* 211, 1-16 (1929).—The cryst. salt of Ba glyceric acid-monophosphoric acid, $C_3H_5O_7PBa + H_2O$, was prepd. The monophosphate was decompd. into its optically active components by means of fractional crystn. of the brucine salt. The hydrolysis by means of phosphatases of different origin and the isolation of the glyceric acid enzymically produced were accomplished. With the aid of Taka-phosphatase no evidence was obtained of an asymmetric hydrolysis. S. MORGULIS

Formation and isolation of methylglyoxal in glucolysis by animal enzymes. MARTHE VOGT. *Biochem. Z.* 211, 17-39 (1929); cf. *C. A.* 23, 4247.—The formation of methylglyoxal in the glucolysis of animal tissues has been fully demonstrated through elementary analyses of its bis-2,4-dinitrophenylhydrazone. The disappearance of the sugar has been followed quantitatively and the yield of methylglyoxal was 27.4 and 17.9% of the theoretical. The opt. condition for good methylglyoxal yields is the use of an alc.-ether prepn. of pig liver and kidney, also washed out liver, kidney and muscle of pig or rabbit. As with alc. sugar fermentation or bacterial lactic acid fermentation the accumulation of the methylglyoxal depends upon the absence of an excessive quantity of coenzyme as otherwise the methylglyoxal undergoes further dismutation. Hexose-diphosphate has been shown to be converted to methylglyoxal but so far expts. with trioses have given neg. results. S. MORGULIS

Changes in activity of blood catalase. A. KULTYUGIN AND G. SAVOSTIANOV. *Biochem. Z.* 211, 131-43 (1929).—The inactivation of a catalase prepn. from cat erythrocytes has been studied at various temps., also under the influence of different electrolytes. The activity was increased by the addn. of blood serum, also of blood albumin or of egg albumin. The inhibiting effect of chlorides and nitrates was also less marked in the presence of serum or of albumin. S. MORGULIS

The mode of action of the thyroid hormone. II. Serum proteases. RUDOLF WEIL AND MARTIN LANDSBERG. *Biochem. Z.* 211, 144-53 (1929); cf. *C. A.* 23, 3979.—The method of Utkin-Ljubowzow for trypsin detn. does not give good quant. results on serum. But even with other procedures it has not been possible to demonstrate an increase in the proteolytic enzymes of the serum under the influence of thyroid secretion. S. MORGULIS

Surface energy and surface activity on a protoplasm model. V. EFIMOV AND P. REHBINDER. *Biochem. Z.* 211, 154-62 (1929). The surface tension σ has been measured by means of Rehinder's app. for detg. the drop pressure between artificial protoplasmic membrane (Nirenstein's fluid) and aq. dye solns. The surface tension at the boundary with pure water was very slight ($\sigma = 7.8$ dyne/cm.); this is attributed to the presence in the Nirenstein fluid of oleic acid which is saponified by the isoamylamine in the water. The dyes are adsorbed on the boundary of this model, lowering the surface tension. The surface activity ($A = -d\sigma/dc$) of these dyes runs parallel to their staining capacity or to the distribution coeff. of the dye in the 2 phases. Furthermore some dyes which in the above expts. manifested considerable surface tension activity had no activity at the boundary of contact with air, and were not adsorbed. Surface-tension measurements at the contact with air are of no value in many biological problems. S. M.

Studies on substituted proteins: nitration and iodation of globins. HUGO BAUER AND EDUARD STRAUSS. *Biochem. Z.* 211, 163-90 (1929).—It is shown that in ovalbumin, serumalbumin and serum globulin the I₂ bound to C stands in stoichiometric relation to the tyrosine content of these proteins, 2 atoms of I being taken up for each tyrosine. This cannot be regarded as a case of adsorption. Globin has a peculiar behavior towards I in that it combines with double the amt. of I that would correspond to its tyrosine content. This leads to the conclusion that here 2 atoms of I become attached to the C in the 3,5 position and 2 more on the imidazole ring of histidine. Nitrated globin contains the NO₂ group in the tyrosine and tryptophan. When the nitroglobin is iodated only one I enters the mononitrotyrosine and 2 atoms of I the histidine. Part of the 2 taken up either by globin or by nitroglobin is split off by cold H₂SO₄, and this hydrolyzable fraction has a definite whole no. ratio to the non-hydrolyzable moiety of the I bound to the C, and is thought to be bound to an NH group. Depending upon the method of iodating (bicarbonate or ammonia) the globin shows the presence of 1 or 2 such NH groups. The combination of I with NH₂ protects the protein from the action of pepsin-HCl. This protection is lost by removing the I and can be again restored. It is therefore concluded that the NH group which binds I is the CO-NH peptide linkage. Changes in soly. in dil. acids and the variation of the pepsin-HCl action

occasioned by heat are compared in these substituted proteins with the behavior of the native proteins.

S. MORGULIS

The carbohydrate of phosphatides. BRUNO REWALD. *Biochem. Z.* 211, 199–201 (1929).—The phosphatide from soy beans yields a carbohydrate which has not yet been obtained in pure cryst. form but which on hydrolysis gives glucose. Expts. with egg yolk lecithin also give evidence of the presence of a di- or poly-saccharide which reduces only after hydrolysis.

S. MORGULIS

Malt amylase. VII. Adsorption of amylase from malt extract on kaolin and its elution. TH. SABALITSCHKA AND R. WEIDLICH. *Biochem. Z.* 211, 229–38 (1929); cf. *C. A.* 23, 4957.—Amylase in aq. exts. can be adsorbed by kaolin at p_H 4.5, 2.5 g. kaolin being sufficient completely to adsorb the amylase from 19 g. malt. The part which is oxidized by alk. I_2 (maltose) is not adsorbed, and constitutes 96% of the dry residue of the malt ext. The amylase is leached out from the kaolin with a phosphate soln. of p_H 7.6, whereby a very large portion is recovered in still active form. An aq. soln. of H_2CO_3 of p_H 5.9 does not dissolve the amylase from its adsorption combination with kaolin. In the process of purification 38–40% of the amylase was lost.

S. M.

Hydrolysis of lecithin. HERMANN PAAL. *Biochem. Z.* 211, 244–51 (1929).—Lecithin shows great thermolability, undergoing complete hydrolysis when warm. Glycerol or water emulsions of lecithin even in the presence of activators and of an opt. p_H are not affected by lipase, but in alc. soln. the lipase cleavage is obvious and the lecithin is unstable on exposure to the air. Choline and fatty acid detns. yield parallel results.

S. MORGULIS

A method for the determination of diffusion constants and the calculation of the radius and weight of the hemoglobin molecule. JOHN H. NORTHROP AND M. L. ANSON. *J. Gen. Physiol.* 12, 543–54 (1929).—The diffusion coeffs. of solutes are detd. from the rate of passage of the solute through a thin porous membrane made of powd. glass between 2 solns. of different concns. By this method the diffusion coeff. of CO hemoglobin was detd. as 0.0420 sq. cm. per day at 5°. The mol. wt. of this compd. was calcd. by means of Einstein's equation as 68,600.

C. H. RICHARDSON

A glucose derivative and the oxidation-reduction equilibrium of the cells. RENÉ WURMSER AND JEAN GELOSO. *Compt. rend.* 188, 1186–8 (1929); cf. *C. A.* 22, 3343.—There exists in the cell a certain quantity of the substance G' derived from glucose which is in equil. with the medium. This material tends to give to the medium a potential $r_H = 8.2$ at 20°. This potential will be attained if the cell is under perfect anaerobic conditions but the presence of O_2 increases r_H from 14 to 22. This max. value is not lowered since the rapid reformation of G' depends on an intermediate form G_1 and this will not take place in the presence of O_2 . G_1 gives to the cell the value $r_H = 15$.

M. H. SOULE

Casein. III. The fractionation of casein (LINDERSTROM-LANG) 2. Porphyrin syntheses (FISCHER, SCHORMÜLLER) 10. Studies on the swelling of gelatin in aqueous solutions of acids, bases and salts, and of mixtures of the same (KÜNTZEL) 2. Acrolein to hemoglobin passing through the antioxygens and colored hydrocarbons, forming dissociable peroxides (rubrenes) (MOUREU) 10. The isoelectric point of coporphyrin and its physiological significance (FINK) 3. The dehydrogenation of succinic acid (HAHN, HAARMANN) 10.

BERNARD, L., AND DEHRÉ, R.: *Cours d'hygiène*. 2 vols. Paris: Masson & Cie. 1247 and 811 pp. F. 160. Reviewed in *Chimie & industrie* 22, 117 (1929).

KISSER, JOSEF: *Tabulae biologicae*. Bd. 5. Suppl. 1. Stickstoff-Assimilation niederer Organismen. Berlin: W. Junk. Pp. 261–70. M. 1.20.

B—METHODS AND APPARATUS

STANLEY R. BENEDICT

Histochemical demonstration of glutathione and its distribution in certain organs. P. DI MATTEI AND F. DULZETTO. *Atti accad. Lincei* [6], 8, 317–20 (1928).—To detect glutathione, the organs, immediately after removal from the animal, are reduced to small fragments, immersed for at least 30 min. in 20% trichloroacetic acid soln., and cut into sections 4–5 μ thick by the freezing method. These are treated on microscope slides, with fresh 5% Na nitroprusside soln. for 3–4 min., freed from excess of this soln. by means of filter-paper, and exposed to NH_3 vapor. An amaranth-red coloration appearing immediately reveals the location of the glutathione. The sections are rapidly cooled in ice or in a jet of CO_2 and examd. microscopically at 5°. The distribution of glutathione in various organs is described.

B. C. A.

The meaning of the Manoïlov reaction. MICHEL POLONOVSKI. *Compt. rend. soc. biol.* 100, 867-70(1929); cf. *C. A.* 19, 3502.—The Manoïlov reaction is not sp. for sex: the final color tint obtained depends (1) on the initial concn. in the blood sample of substances more oxidizable than the dye added; (2) the amt. of KMnO_4 used; (3) the reaction of the medium; (4) the time of contact of the reagents. The greater part of the oxidation by KMnO_4 takes place after the HCl is added. P. simplifies the technic by adding the HCl first and then detg. the amt. of KMnO_4 required to produce total decoloration. B. C. BRUNSTETTER

The value of the Manoïlov reaction. M. POLONOVSKI AND P. BOULANGER. *Compt. rend. soc. biol.* 100, 870-3(1929).—Figures are presented to show that both the original technique of the Manoïlov reaction and P.'s modification do not significantly differentiate between male and female blood. The amt. of KMnO_4 required to produce decoloration of red blood cells depends only, other factors being equal, on the amt. of hemoglobin present, and hence can serve as the basis of a rapid technic for detg. blood hemoglobin. B. C. BRUNSTETTER

A new gas analysis apparatus. The technique of gas analysis. ERNST SIMONSON. *Arbeitsphysiol.* 1, 564-9(1929).—Descriptions are given of minor modifications of the Haldane portable gas analysis app. and of an app. for the analysis of two samples at the same time. T. M. CARPENTER

Simplification of respiration experiments by the Douglas-Haldane method. ERICH A. MÜLLER. *Arbeitsphysiol.* 2, 18-22(1929).—Douglas bags were lined with thin metal foil and vulcanized. This reduced the passage of CO_2 so that Hg samplers were not necessary. A modified 3-way valve and automatic arrangement for operating the Haldane gas analysis app. are described. T. M. CARPENTER

Method for determining carboxyl groups in protein digestion products. I. A. SMORODINTZEV, A. N. ADOVA AND S. S. CHULKOVA. *Fermentforschung* 11, 37-44 (1929).—A study was made of the method proposed by Felix and Müller (*C. A.* 22, 369) which consists in titrating COOH in aq. instead of alc. soln., using alizarin yellow in place of thymolphthalein as indicator. It is important to employ a very dil. indicator (0.5 cc. of 0.01% per 10 cc. of soln.), since the eye is less sensitive to color shades of greater intensity. The 0.2 *N* NaOH used in titration should also contain 0.01% indicator so that the final color comparisons are made at the same concn. The end point should correspond to p_H 11, because this represents the theoretical value for a molar mixt. of glycine and alkali, and because the color shades are here more easily distinguished. The titration is made from a microburet and the color matched with a standard prepd. by adding the indicator in the same concn. to a buffer soln. of 0.15 *N* Na_2HPO_4 and 0.2 *N* NaOH , or 0.1 *N* glycine and 0.1 *N* NaOH ($p_H = 11.04$). The titration values are somewhat higher than those in the Willstätter method, because of the higher p_H of the end point and the absence of protein pptn. The values are, however, consistent and suitable for purposes of comparison in detg. enzyme activity and extent of digestion. A. W. DOX

Estimation of urea in urine. HANS KAISER AND KARL EGGENSBERGER. *Süd. deut. Apoth.-Ztg.* 69, 337-8(1929).—A discussion of several methods in common use, preference being given to the xanthhydrol method on account of its ease in execution, the urea being weighed as dioxanthylurea. W. O. E.

The determination of the tension of gases in the urine and other fluids containing carbonates. F. MAINZER AND C. T. SHEN. *Arch. ges. Physiol.* (Pflüger's) 222, 1-11 (1929).—Methods are described for detg. the O_2 and CO_2 tensions in urine and for calcg. the soly. coeffs. and the apparent dissocn. consts. of CO_2 in biol. fluids. The O_2 tension in human urine varied from 23 to 101 mm. and the CO_2 from 43 to 102 mm. of Hg. ARTHUR GROLLMAN

A new electrode for the measurement of the hydrogen-ion concentrations of small quantities of fluid in living organisms. T. VON LANZ AND G. MALYOTH. *Arch. ges. Physiol.* (Pflüger's) 222, 534-40(1929). ARTHUR GROLLMAN

The oxidation of dioxanthylurea by means of the dichromate reaction. A new method for determining urea. FRANK W. ALLEN AND JAMES M. LUCK. *J. Biol. Chem.* 82, 693-701(1929).—A microchem. method is described for the pptn. of urea as dioxanthylurea from urine, blood and tissues. This deriv. is then estd. by oxidation with $\text{K}_2\text{Cr}_2\text{O}_7$ and the excess of the latter detd. iodometrically. ARTHUR GROLLMAN

An improved technique for microchemical determination of calcium. PAUL L. KIRK AND CARL L. A. SCHMIDT. *J. Biol. Chem.* 83, 311-4(1929).—A microfilter is described which facilitates the detn. of Ca volumetrically. The method is suitable for blood Ca analyses. ARTHUR GROLLMAN

A rapid and accurate method for determining the quantity of yeast or other micro-

organisms in a suspension. ROGER J. WILLIAMS, EDWARD D. MCALISTER AND RICHARD R. ROEHM. *J. Biol. Chem.* 83, 315-20(1929).—The yeast suspension is interposed between a light and a specially prepd. thermocouple. The e. m. f. set up by the thermocouple measures the concn. of the suspension. ARTHUR GROLLMAN

The Bergeim test for intestinal putrefaction. FREDERICK HOELZEL. *J. Biol. Chem.* 83, 331-2(1929).—The Bergeim test is not specific, for high figures for the reduction of Fe_2O_3 are obtainable, independent of any putrefaction. ARTHUR GROLLMAN

An electrometric method for the determination of chloride in whole blood and animal tissues. J. C. FORBES AND H. IRVING. *J. Biol. Chem.* 83, 337-44(1929).—The method of Bond and Haag (*C. A.* 21, 2005) was modified for the detn. of Cl^- in biological materials. The app. consists of a portable d'Arsonval galvanometer, a Clark calomel electrode vessel and the usual form of Ag electrode. Satisfactory results were obtained on solns. of known Cl^- content as well as when compared with Van Slyke's method for the detn. of Cl^- in whole blood and tissues. ARTHUR GROLLMAN

A rapid and accurate method for the determination of urea in blood. S. L. LEIBOFF AND BERNARD S. KAHN. *J. Biol. Chem.* 83, 347-52(1929).—The sample is digested with acid in a special pressure tube for 10 min. at 150° . The NH_3 thus formed is nesslerized and detd. colorimetrically. ARTHUR GROLLMAN

Oxidation-reduction systems of biological significance. V. The composition of the oxidized cobalt complex of cysteine. A colorimetric method for the microanalysis of cobalt. L. MICHAELIS AND S. YAMAGUCHI. *J. Biol. Chem.* 83, 367-73(1929).—The oxidized complex of Co and cysteine is shown to have the formula: $\text{Co}(\text{SCH}_2\text{NH}_2\text{CH}_2\text{COO})_2\text{H}_2$. The formation of this complex can be utilized for the colorimetric microanalysis of Co. ARTHUR GROLLMAN

The determination of acetone bodies in blood and urine. Reply to criticism by E. C. Smith. DONALD D. VAN SLYKE. *J. Biol. Chem.* 83, 415-23(1929).—The basic mercuric salt ppts., obtained in the author's methods, yield the same proportions of acetone as when solns. of pure acetone or β -hydroxybutyric acid are used. A. G.

Manometric determination of primary amino nitrogen and its application to blood analysis. DONALD D. VAN SLYKE. *J. Biol. Chem.* 83, 425-47(1929).—The manometric app. of Van Slyke and Neill is applied to the gasometric detn. of primary aliphatic amino N by the HNO_3 reaction. Detns. can be made in 5-cc. portions of Folin-Wu blood filtrate. ARTHUR GROLLMAN

The manometric determination of urea in blood and urine by the hypobromite reaction. DONALD D. VAN SLYKE. *J. Biol. Chem.* 83, 449-61(1929).—Urea may be detd. approx., within 3 min., by the Van Slyke-Neill manometric gas app. The method is sufficiently accurate for clinical use and may serve as a substitute for non-protein-N estns. ARTHUR GROLLMAN

The estimation of calcium in the blood. A new microchemical method. GUIDO MELLI. *Polislinico (Sezione Med.)* 1927, 21 pp. sep.; *Chem. Zentr.* 1928, II, 89.—Protein material was pptd. by UCl_4 and addn. of a small quantity of HCl . A 0.3-0.5-g. sample of blood is warmed with the above for 1 hr. to dissolve the Ca. $\text{Concd. (NH}_4)_2\text{C}_2\text{O}_4$ and NH_3 is added until the yellow color is displaced by neutral red and pptn. occurs. Glacial AcOH is added until a rose color appears and after 3-5 min. on the water bath, the soln. is centrifuged. The optimum for pptn. is at pH 6-7.4. The washed needles are mixed with 3 cc. of a $1/100$ N KI soln. and cooked in an autoclave at a pressure of 2 atm. for 20-25 min. After standing on a steam bath for 30-40 min., the soln. is titrated with $1/100$ N As_2O_3 or $1/100$ N $\text{Na}_2\text{S}_2\text{O}_3$ with starch for an indicator. The difference between cc. of KI added and cc. of titrating soln. used, multiplied by 0.12, gives Ca in mg. F. P. GRIFFITHS

Observations on the iodine-containing compounds of the thyroid gland. Isolation of *dl*-3,5-diiodotyrosine. CHARLES R. HARRINGTON AND SYDNEY S. RANDALL. *Biochem. J.* 23, 373-83(1929).—All of the thyroxine is probably found in the acid-insol. fraction, whereas the whole of the acid-sol. I is present as diiodotyrosine. The isolation of *dl*-3,5-diiodotyrosine, pale, straw-colored, prismatic needles, m. 198.4° , is described in detail. B. HARROW

The oxidation-reduction potentials of some vital stains. L. RAPKINS, A. P. STRUYK AND R. WURMSER. *J. chim. phys.* 26, 340-8(1929).—Basing their work on the expts. of Clark, using TiCl_3 and electrometric titrations, the authors conclude that certain vital stains have oxidation-reduction potentials sufficiently definite to permit of their use in detg. intracellular oxidation-reduction potentials. While usually it is essential that no notable chem. change shall occur in the stains as they penetrate the cells, it was found that the demethylation of methylene blue, which took place in some cases, did not very materially affect oxidation-reduction potential measurements made

by it. The stains used, in order of increasing neg. potentials, were basic salts of an oxazine, *i. e.*, cresyl blue, the thiazines, toluidine blue and blue azure I; the naphtho-phenazo-oxonium compds., Nile blue, and cresyl violet; and the azines Janus green and neutral red. A chart of the measurements is included. G. ALBERT HILL

Determination of sugar in blood. STANLEY R. BENEDICT. *J. Biol. Chem.* 83, 165-8(1929); cf. *C. A.* 22, 1375.—Everett's criticism (*C. A.* 23, 3941) of B's latest method for the detn. of blood sugar is based upon a superficial examn. of the method. When reasonable care is used there is no evidence of the alleged more rapid fading of the unknown than of the standard within 10 min. Everett's work "may be of value to some in drawing attention to the fact that in the use of the new method, the solns. should not stand around the lab. for long periods before the readings are made. This finding, however, is equally true of most of the commonly used colorimetric methods." A criticism by West, Scharles and Peterson (*C. A.* 23, 2999) "is based wholly upon theoretical objections to a procedure which they have apparently not employed for even a single detn."

A. P. LOTHROP

The quantitative determination of bile acids by means of a new color reaction and monochromatic light. RAYMOND GREGORY AND T. A. PASCOE. *J. Biol. Chem.* 83, 35-42(1929).—Dil. bile acid solns. give a pure blue color when treated with 34 vol. % H_2SO_4 and 0.05 vol. % furfural and the mixt. heated for 30 min. at 65° . The colored compd. is stable for 2-3 hrs., perfectly reproducible and quant. in nature. The reaction is termed the "Gregory reaction." Various substances other than bile acids which give a positive Pettenkofer reaction are negative to the Gregory reaction. A method is described for the detn. of bile acids based on the Gregory reaction. Monochromatic light must be used and is obtained from a coiled neon tube and passed through suitable filters to eliminate the undesired wave lengths. No bile salts were found in 2 trials with about 5 l. of blood each, results entirely contrary to those reported by Rowntree, Greene and Aldrich (*C. A.* 22, 623) who used a modified Pettenkofer procedure and found 2.5 to 6 mg. per 100 cc. of normal blood.

A. P. LOTHROP

A manometric method for the determination of gas in fermentations. ALBERT L. RAYMOND. *J. Biol. Chem.* 83, 611-8(1929).—An app. is described for detg. the gas production in fermenting mixts. which is based on Slator's method (*J. Chem. Soc.* 89, 128(1906)) of measuring the increase in pressure at const. vol. It has been designed for easy and rapid detn. of several simultaneous samples.

A. P. LOTHROP

A microchemical method for the determination of potassium with special regard to biological liquids. F. P. MAZZA AND A. ROSSI. *Arch. sci. biol.* (Italy) 13, 466-72(1929).—Reagents: (1) Mix 20 cc. of a 20% $NaNO_3$ soln. with 5 cc. of a soln. of 50 g. $CoCl_2 \cdot 6H_2O$ and 20 g. $AcOH$ in H_2O (vol. 100 cc.), (2) 0.02 *N* soln. of $KMnO_4$, (3) a soln. of $FeSO_4$ about 0.02 *N*, (4) 5% $NaNO_3$ soln. Mix in a centrifuge tube 1 cc. of the soln. or serum to be tested with 3 cc. of (1) and centrifuge after 30 min. Wash the ppt. 3 times with 5 cc. of (4). Dissolve 1 g. $NaHCO_3$ in 5 cc H_2O at 100° . Add the soln. to 10 cc. of (2) and wash with H_2O . Add (3) until the soln. is colorless and (2) again until a pink color is obtained. Soln. (3) must be standardized against 2. If *n* cc. of 2 are consumed, the serum contains $n(0.776 + 0.0005n)$ mg. K_2O . The av. error is 1%.

A. E. MEYER

Colloidal silver iodide in urologic radiology. UBALDO ISNARDI. *Semana méd.* (Buenos Aires) 36, 863-7(1929).—Colloidal AgI permits a gradation of the shadows; it is sol. in H_2O , does not stain, and is innocuous and antiseptic.

A. E. MEYER

The presence of citric-dehydrogenase in cucumber seeds and its utilization for a highly sensitive biological color reaction for citric acid. TORSTEN THUNBERG. Univ. Lund. *Biochem. Z.* 206, 109-19(1929).—A phosphate ext. of cucumber seeds contains a variety of dehydrogenases, of which the citric-dehydrogenase is most remarkable for its high sensitivity. Exts. can be prepd., which, with the aid of the Thunberg methylene blue method, produce max. decoloration with 0.01 mg. citric acid. This serves, therefore, to det. the citric acid in various biological materials, like milk or urine, without the need of previously extg. or concg. the acid. A cc. of urine or milk is sufficient for the detn.

S. MORGULIS

Determination of potassium, sodium, chlorine and phosphorus in small quantities of organic matter. E. ERNST AND I. BARASITS. *Biochem. Z.* 209, 438-46(1929).—Muscle tissue is ashed dry in an elec. oven at beginning red heat. It was unnecessary to add any reagents for the ashing; the Cl could be quantitatively recovered from the ash; P is not sublimated but changed to meta- and pyrophosphates. In order to get the reaction of molybdic acid the ash must be treated with H_2SO_4 to convert the P back into orthophosphate. The Na is detd. as the $NaZn(UO_4)_2(C_2H_3O_4)_2 \cdot 9H_2O$. The pptn. was made in a small centrifuge tube provided with a thick capillary calibrated according

to different amts. of ppt. This procedure is further checked up by a colorimetric method which is essentially that of Barrenscheen and Nessiner only the standard Na soln. is prepd. by dissolving the ppt. in water contg. 0.5 cc. 10% AcOH which keeps for a long time. Five cc. of the muscle ash soln. is treated with 5 cc. of a satd. alc. soln. of $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2$ which removed the phosphates. After filtration 2 cc. is used to ppt. the Na. The K detn. is carried out in similar capillary centrifuge tubes, and the ppt. obtained according to the Kramer-Tisdall method is also detd. by titration with KMnO_4 . The Cl is detd. by the Volhard method in 5 cc. of the ash soln. and the results are in good agreement with Katz findings with various ashing procedures. For the P detn. 5 cc. of the ash soln. is boiled with 5 cc. 20% H_2SO_4 , the final vol. is adjusted to 10 cc. and P detns. by the Bell-Doisy method are made on 2-cc. portions.

S. MORGULIS

A new qualitative test for saccharase. Z. I. KERTÉSZ. *Biochem. Z.* 209, 492-4 (1929).—To 50 cc. H_2O are added 5 g. sucrose and a little KH_2PO_4 . This is warmed to 40-45°. A small amt. of the substance to be tested saccharase is now added, and after a while the soln. is tested for levulose by means of Ekkert's reagent (C. A. 23, 2125). It is necessary to be sure that the mixt. contains no levulose. An intense brownish red color develops quickly in the presence of levulose upon the addn. of this reagent.

S. MORGULIS

A convenient microquinhydrone electrode for measuring the hydrogen-ion concentration in very small pieces of tissue. N. OKUNEV. *Biochem. Z.* 210, 1-6 (1929).—A microquinhydrone electrode is described in which the main features are the small gold-plated Pt plate in place of the ordinary Pt wire. The investigated tissue is placed in a glass tube where it comes in contact with the Pt electrode. The tube ends in a capillary plugged up by an agar-KCl mixt. which serves as the bridge. Good results were obtained.

S. MORGULIS

Manometric determination of the peptide hydrolysis. HANS A. KREBS AND J. F. DONEGAN. *Biochem. Z.* 210, 7-23 (1929).—Since peptides are stronger acids than amino acids, when the former undergo hydrolysis in a Ringer soln. with a physiol. HCO_3^- and CO_2 content CO_2 becomes absorbed. This absorption can be measured manometrically. Two procedures are described for employing this manometric procedure for the detn. of the peptide hydrolysis, and the results are checked by the Van Slyke and by the polarimetric methods.

S. MORGULIS

Method for the determination of lactic acid in animal fluids and tissues. SHIZUO TANAKA AND MASAHARU ENDO. *Biochem. Z.* 210, 120-42 (1929).—A no. of improvements are suggested in carrying out the lactic acid detn. by the von Fürth method. For tissues the procedure is: 15 cc. of 30% KOH is brought to a boil and the tissues to be analyzed are thrown into it and boiled 5 min. The lactic acid remains unchanged in the fluid which on cooling is neutralized with 30 cc. 15% H_2SO_4 and is made up to 60 cc. in a cylinder. The proteins and fat are now thrown down by addn. of 25 g. $(\text{NH}_4)_2\text{SO}_4$ and filtered off. Sixty cc. of the filtrate is extd. 4 hrs. with 120 cc. ether after the preliminary addn. of 10 cc. dil. H_2SO_4 , 20 cc. H_2O and a small quantity of Li_2CO_3 . With blood the proteins are removed by slowly pouring 1 vol. into 6 vols. of 96% alc. After allowing the ppt. to settle for 10 hrs. the material is filtered. To the filtrate is added 0.2 g. Li_2CO_3 and evapd. to dryness. The residue is boiled with 30 cc. H_2O and 1 g. animal charcoal whereby lipides and other interfering substances are removed. The filtered material is acidified with 70-80 cc. 20% H_3PO_4 and extd. with ether as before. The oxidation of the lactic acid is carried out in a CO_2 atm. whereby any further oxidation of the aldehyde is prevented. Likewise the NaHSO_3 soln. used for taking up the resulting aldehyde is satd. with CO_2 and is kept in an atm. of CO_2 . The extn. of the lactic acid is made in the Kumagawa-Suto app. By means of this procedure even 1 mg. lactic acid in tissues or body fluids can be accurately analyzed.

S. MORGULIS

Experiments on a titrometric microchemical determination of cholesterol. A. HINRICHS AND L. KLEMM. *Biochem. Z.* 210, 191-7 (1929).—Two cc. blood is warmed on the water bath with 5 cc. 2% NaOH until the red cells completely dissolve. This is transferred with H_2O to a small separatory funnel and the free cholesterol is extd. 4 times with 10 cc. CHCl_3 . To det. total cholesterol 1 cc. blood is heated with 10 cc. 5% alc. NaOH under a reflux for 8 hrs. This is dild. 3 times with water and extd. in the separatory funnel. To avoid the formation of emulsions in the extn. of the free cholesterol a few cc. concd. NaOH is added, and the first extn. is made without vigorous shaking. The collected CHCl_3 exts. are evapd. and the residue is taken up with about 6 cc. boiling acetone. The soln. is filtered through a fat-free paper. The soln. should be reduced to a vol. of 2 cc. and should not be filtered if a turbidity results. The pptn. is made with 1 cc. 2% digitonin in 80% alc. The filter must be washed with 100-150

cc. hot H_2O to remove all digitonin. The cholesterol digitonin compd. is detd. by titration after oxidation with chromic acid. S. MOROGLIS

Experiments on the preparation of the female sex hormone from the urine of pregnant women. S. VESHNYAKOV AND A. LIPSCHÜTZ. *Biochem. Z.* 210, 348-52 (1929).—The pregnant urine is evapd. to sirup and mixed with alc. (1 l. for 10 l. of urine). The ppt. is allowed to settle for several hrs. It is then washed once more with a similar vol. of alc. The combined alc. liquids which are poured off are evapd. *in vacuo* on a water bath and the residue (about 15 cc. per l. of urine) is extd. with ether 8-10 times. After redistilling the ether the residue is boiled on the water bath with 10% NaOH. The liquid is again extd. with an equal vol. of ether. The first ext. is kept separately, then the liquid is extd. 8-10 times with 3-4 vols. of ether. The residue of this ether ext. is yellow. It is weighed and dissolved in alc., and for injection this soln. is dild. with physiol. saline soln. The yield is about 3300 mouse units per l. of urine. In this prepn. each unit corresponds to 0.01 mg. but by further repeated extn. with ether of the aq. soln. a prepn. of approx. 0.001 mg. to the unit was made. The first ethereal ext. of the sapond. material contains a variety of sol. compds. besides the hormone. The hormone is obtained in purer form when this first ext. is shaken 10 times with water in a separatory funnel, breaking up any emulsion by means of a little alc. This aq. soln. was evapd. *in vacuo* on the water bath, dissolved in ether and once more extd. with water, whereupon a prepn. with each unit = 0.01 mg. is obtained. S. M.

Tyrosine and tryptophan determination by the method of Tillman, Hirsch and Stoppel. HUGO BAUER AND EDUARD STRAUSS. *Biochem. Z.* 211, 191-8 (1929).—The colorimetric method of Tillman, Hirsch and Stoppel for tyrosine and tryptophan detn., based upon the xanthoproteic reaction and developed for purposes of food stuff analysis, is not applicable to the study of nitrated proteins. The method was therefore modified in that the reaction was carried out at ordinary room temp. instead of by heating. The results thus obtained are still not very accurate. S. MOROGLIS

Comparative studies on the determination of the proteins in blood serum. FRITZ SCHNEIDER. *Biochem. Z.* 211, 207-12 (1929).—A comparative study of 3 methods for detg. the blood serum proteins has been made on 51 samples of both normal and pathol. sera. The gravimetric procedure gives results which are in agreement with those obtained by the Kjeldahl method. The refractometric method yields results which differ from the other 2 though not as much as is sometimes claimed. The refractometric procedure is therefore still a valuable method to use for clinical purposes, if an accuracy which does not exceed the limit of ≈ 0.3 g. protein is desired. S. M.

Determination of p_H at 37° in succinate dehydrogenase solutions with the quinhydrone electrode. JÖRGEN LEHMANN. Univ. Lund. *Skand. Arch. Physiol.* 55, 288-306 (1929).—The applicability of the quinhydrone electrode for measuring p_H in a micro-heterogeneous colloidal enzyme soln. which oxidizes succinic acid has been studied by comparison with detns. made by the H electrode. In acid or slightly alk solns., following the initial rise of the π^{CH} , its value becomes and remains const. for about an hr. The difference in p_H between the quinhydrone and the H electrode was not greater than 0.01 p_H . In enzyme solns. of greater alky. ($p_H > 7.60$) no stable potential is obtainable. However, by reading the potential $1-1\frac{1}{2}$ mins. after the addn. of quinhydrone to the enzyme soln. previously warmed to 37° detns. accurate to 0.01 p_H could be had up to a $p_H = 7.60$, but at $p_H > 8.0$ the errors occurred in the first decimal. S. M.

Method for determining on the corpse of an infant the degree of intoxication of the nurse. DERVIEUX, SZUMLANSKI AND H. DESOILLE. *Ann. méd. légale criminol. police sci.* 9, 501-4 (1929).—Alc. taken by a nursing woman can be detected in the milk within 15 min. of its ingestion, reaches a max. after about 45 min., and can still be detected after 4 hrs. The alc. content of the milk in the stomach of the infant cannot be higher, but can be considerably lower, than that of the milk as ingested, and the alc. content cannot be increased by fermentation of the sugar contained in the milk. A. P.-C.

A method for the titration of complement. HARRY EAGLE. *J. Gen. Physiol.* 12, 821-3 (1929).—This method makes use of the fact that the time required for hemolysis is a function of the quantity of complement. A reference time curve is obtained with known quantities of complement using a fixed amt. of standard sensitized cell suspension. The time required for the unknown soln. to cause hemolysis at a certain temp. and volume is detd. and the complement content read from the reference curve by interpolation. C. H. RICHARDSON

Preparation of Besredka media with egg yolks. FERNANDO MODERN AND N. V. D'ALESSANDRO. *Anales asocn. quim. Argentina* 16, 221-4 (1928).—To 100 cc. of egg yolk is added 300 cc. distd. H_2O . The mixt. is clarified by adding 10-15 cc. of 1% NaOH soln. until alk. to phenolphthalein by the drop method. Exactly 0.1 cc. of 0.1%

phenolphthalein soln., 3 cc. of the above emulsion, and 6.5 cc. distd. H_2O are put into a tube (1). In another tube (2) is put 7 cc. distd. H_2O and 3 cc. of egg yolk emulsion. Both tubes are placed in a Walpole comparator. The $p_H = 9.4$ soln. is prepd. from the Michaelis data as follows: A tube (3) like the others in size, contg. 0.34 cc. of 0.1% phenolphthalein soln. and 9.66 cc. of 0.005 N NaOH, is placed in front of tube (2) in the comparator. Behind tube (1) is placed a fourth tube contg. distd. H_2O . There is detd. the quantity of 1% NaOH soln. to be added to tube (1) to equalize colors.

E. M. SYMMES

Simple method for softening plaster casts. HERMANN EMDER. *Pharm. Acta Helv.* 3, 146-8(1928).—To obviate laborious efforts in breaking up surgical plaster casts, E. recommends applying a concd. soln. of $BaCl_2$ (200 g. in soft well water 1000 cc.) warmed to 40-60°. The plaster absorbs the soln. with avidity, thereby becoming readily softened and workable. Only in a few special cases, precautions must be taken to prevent the poisonous $BaCl_2$ finding its way into the blood stream. The method is in successful use at the Basel Univ. clinic.

S. WALDBOTT

A new method of mounting vegetable powders for microscopic examination. W. O. HOWARTH. *Pharm. J.* 122, 522-3(1929).—In the place of chloral hydrate, G. Sutton uses "lactophenol:" PhOH 20, lactic acid 20, glycerol 40 and H_2O 20 parts. Suitable stains may be added. This medium brings out the details of cell structure and tissues of algae, fungi, etc.

S. WALDBOTT

Twin tubes with a membrane filter (ASHESHOV) 1. A glass electrode apparatus for measuring the H-ion concn. values of very small volumes of solution (MACINNES, DOLE) 1.

BAUER, HUGO: *Handbuch der biologischen Methoden*. Abt. 1. Chemische Methoden. Tl. 2, Hälften 2, H. 5 (Lfg. 299). Halogenieren. Edited by EMIL ABDERHALDEN. Berlin and Vienna: Urban & Schwarzenberg. Pp. 2309-2584. M. 14.

Handbuch der biologischen Arbeitsmethoden. Edited by EMIL ABDERHALDEN. Abt. 4. Angewandte chem. u. physikal. Methoden. Tl. 11, Heft 2 (Lfg. 295). WALTER STRAUSS: Die Untersuchungs-methoden d. Kleidg. KARL v. ANGERER: Die Methodik d. bakteriolog. Luftuntersuchg. Die Methodik d. bakteriolog. Wasseruntersuchg. ALOIS LODGE: Hygien. Methoden d. Luftuntersuchg. Berlin and Vienna: Urban & Schwarzenberg. Pp. 87-362. M. 14.

C—BACTERIOLOGY

CHARLES B. MORREY

Behavior of tubercle bacillus towards acetyl, benzoyl and cinnamyl chlorides. ENRICO FRANCO. *Boll. soc. ital. biol. sper.* 3, 1335-6(1928).—Tubercle bacilli placed in contact with one of these compds. for a min. of 60, 30, 45 min., resp., washed with physiol. soln., and placed in nutrient soln., lose all activity. They are no longer stained by fuchsin. Guinea pigs and rabbits inoculated with them, acquire a certain resistance with no demonstrable anti-bodies.

A. W. CONTIERI

Disinfecting power of mercuric chloride on wool bearing tuberculous matter. ANTONIO CEREDI. *Boll. soc. ital. biol. sper.* 3, 1336-40(1928).—Wool absorbs up to $\frac{1}{10}$ its wt. of $HgCl_2$ soln. Therefore, to disinfect wool, an excess of $HgCl_2$ soln. must be taken. Using a 5% soln. C. found that 25 times the wt. of wool is required to sterilize wool spread with tuberculous material.

A. W. CONTIERI

The physiology and pathology of the blood gases in tuberculosis. I. General consideration. FRITZ POMPLUN. *Z. Tuberk.* 50, 387-403(1928).—P. reviews the literature and describes the technic of blood gas analysis and also presents data on O and CO_2 of the venous and arterial blood in mainly female patients with and without pneumothorax. His findings suggest the use of O- CO_2 inhalation therapy in selected cases.

H. J. CORPER

The chemistry of the lipoids of tubercle bacilli. IV. Concerning the so-called tubercle bacilli wax. Analysis of the purified wax. R. J. ANDERSON. *J. Biol. Chem.* 83, 505-22(1929); cf. C. A. 23, 4964.—The purified wax from tubercle bacilli is a white powder, m. 200-5°, yielding 71% of Et_2O -sol. and nearly 40% of H_2O -sol. constituents on hydrolysis. Approx. 56% of the total wax consists of a snow white powder possessing both acid and alc. properties which is designated unsaponifiable wax. The true fatty acids present are cerotic, probably a eutectic mixt. of palmitic and stearic, oleic, and a liquid satd. fatty acid analogous to phthioic acid. The H_2O -sol. constituents consist of glycerophosphoric acid, a mixt. of reducing sugars that give pentose reactions and some N-contg. compd. that has not been identified. The purified material is

therefore not a wax but essentially a complex phosphatide contg. a large amt. of carbhydrate.

The use of dyes in the isolation of a nitrite-oxidizing organism. A. P. LOTHROP. CHAS. C. PROUTY. *Soil Science* 28, 125-36(1929).—Dyes of the phenylmethane, xanthene, azo and quinone-imide groups were studied and the most favorable results obtained were with rosaniline-HCl. The 2 most objectionable contaminating organisms can be eliminated from crude cultures of the nitrite-oxidizing bacteria by treatment with 1% solns. of rosaniline-HCl for 5-30 min. Fourteen references are given.

Coproporphyrin of yeast. HERMANN FINK. *Biochem Z.* 211, 65-130(1929); cf. C. A. 23, 5108.—Two types of *Saccharomyces ananensis* have been cultured for over a year under conditions favorable to the accumulation of coproporphyrin. The organisms were propagated over more than 30 generations, and the accumulation of the coproporphyrin has not resulted in the death of any culture. During a period of good growth and fermentation the p_H of the culture dropped from neutrality to p_H 4.0. The no. of cells showing red fluorescence under a fluorescence microscope at each transfer corresponded more or less to the no. of dead cells. The high glycogen content was assocd. with a low protein content. Apart from the porphyrin accumulation it is noteworthy that intensely red pigments appear and disappear, their formation being dependent upon light. The cytochrome spectrum can be observed even in the very old cultures. The isoelec. point of coproporphyrin has been detd. as $p_H = 4.0$ and is characterized by a no. of crit. properties such as min. soly. or max. adsorption, and especially the optical behavior. About 70-80% of the porphyrin is loosely attached to the cells and in neutral or slightly alk. medium can be washed out without causing any damage. The copro cells with red fluorescence disappear. It is clear also why on transferring to a fresh medium of p_H 7.0 coproporphyrin passes from the cells in soln. The remaining 20-30% of the porphyrin are within the yeast cells and cannot be obtained before the cells are killed. On the other hand, the cells adsorb the porphyrin from its soln. when the p_H of the yeast suspension changes to 4.0. Both the dead and the autolyzing cells adsorb quantitatively even from the red fluorescent substance extremely dil. porphyrin soln. Coproporphyrin penetrates into the dead cells, but the living cells only adsorb it on the surface. These observations explain the changes which take place when a new culture is started by transference, the porphyrin at first going into soln. in the nutritive medium, then becoming again adsorbed on the cells as the culture ages; and the appearance and disappearance of the red fluorescent copro-cells are simply results of successive elutions and adsorptions.

The excitation of bacterial fluorescence by beta and gamma rays. P. R. PEACOCK AND LIONEL E. H. WHITBY. *Brit. J. Radiology* 2, 228-33(1929).—Ca phosphotungstate in 5% soln. has an increased bactericidal effect when excited by β or γ rays. This effect may be due to the presence of an impurity.

The penetration of luminous bacteria by the ammonium salts of the lower fatty acids. I. General outline of the problem, and the effects of strong acids and alkalies. SAMUEL E. HILL. *J. Gen. Physiol.* 12, 863-72(1929).—The ability of various substances to penetrate the luminous *Bacillus fischeri* was studied, the criterion of cell penetration being the disappearance of light. These bacteria are cytolyzed by water, hypotonic solns., and by freely penetrating solns. They are not injured by H^+ or OH^- within the p_H range employed with the NH_4 salts. The disappearance of light in isotonic solns. of these salts must be due to penetration of the salts or their hydrolytic products. HCl or NaOH must combine with some substance in the cell membrane to form a permeable substance or simply etch the cell membrane before entrance is possible; but NH_3 and fatty acids pass freely into the cell without first preparing a path of entrance.

Low-temperature pasteurization with special reference to the destruction of epidemic agents (ZELLER, et al.) 14. **Organo-Hg compounds [bactericidal agents]** (Brit. pat. 307,532) 17.

D—BOTANY

THOMAS G. PHILLIPS

The chemistry of the formation of poison in plants. ROBERT E. SADTLER. *Sci. Monthly* 1929, 360-71.

The action of carbon monoxide on green plants. M. PADOA AND NERINA VITA. *Ann. chim. applicata* 19, 141-8(1929).—*Elodea canadensis*, *Lemna minor* and *Plantago major* in presence of large concns. of CO are inhibited in their powers of assimilation, while at low concns. the power is greatly reduced. On the other hand the respiration

is enhanced, especially at high concn., when there is about 80% increased consumption as measured by evolved O_2 . CO does not destroy the cellular structure of plants, as $CHCl_3$ and other anesthetics; thus no HCN is evolved. CO also inhibits alc. fermentation, and greatly retards inversion of sugar.

A. W. CONTIERI

Experimental chemical contributions to genetics. II. HANS VON EULER, SVEN STEFFENBURG AND HARRY HELLSTRÖM. *Z. physiol. Chem.* 183, 113-22(1929); cf. *C. A.* 23, 4241.—Two varieties of *Brassica* at various stages of germination showed a proportionality between catalase activity and the no. of chloroplasts present. In the case of 3 barley mutants this relationship was not observed. Further detns. with barley gave a catalase ratio between normal and white seedlings of 3.3 for germination in the dark and 5.5 after exposure to light. One albino showed a ratio of 1.6 and another 3.4.

A. W. DOX

The maximum amount and the daily course of carbon dioxide assimilation. P. BOYSEN-JENSEN AND D. MÜLLER. *Jahrb. wiss. Botan.* 70, 493-502(1929).—Leaves of *Alchemilla*, *Betula* and *Plantago* assimilated $1/6-1/2$ as much CO_2 as reported by Kostytschew and his co-workers. Marked fluctuations in the amt. of assimilated CO_2 did not occur during the day, nor were there any neg. values such as those cited by Kostytschew. The app. used is that previously described (*C. A.* 23, 4968). Size of stomatal aperture as well as all external conditions were taken into consideration in these expts.

A. E. HITCHCOCK

The permeability of corn seed coats. ALEXANDER GUREWITSCH. *Jahrb. wiss. Botan.* 70, 657-705(1929).—Permeability of corn seed coats to ions of org. and inorg. salts and of dyes was detd. by the diffusion and elec. resistance methods. The membrane is pictured as a micellar structure (hydrophilic gel) which in a swollen state allows permeable ions to pass through the narrow intermicellar passages. The rate of diffusion depends largely upon the swollen state of the membrane.

A. E. HITCHCOCK

Physiological experiments on the germination and growth of certain fern spores. JOHANNES STEPHAN. *Jahrb. wiss. Botan.* 70, 707-41(1929).—The max. germination and growth of spores of *Osmunda regalis*, and of certain other genera, occurred in light. Nutrient solns. of Tottingham, Knop, A. Meyer and Crone gave best results at a concn. of approx. 0.16%. The addn. of H_3PO_4 to the nutrient soln. accelerated germination and growth. In darkness solns. of dextrose or glycerol were more efficient than the standard nutrient solns. The blue end of the spectrum appeared to be necessary for normal growth of the prothallium, the red end alone producing long, narrow prothallia with no lateral meristematic growth. It is not certain how much of the growth response to different qualities of light may be due to differences in light intensity. These results are not in entire agreement with those of Klebs (1916-17).

A. E. HITCHCOCK

Determination of the filtration resistance of roots. OTTO RENNER. *Jahrb. wiss. Botan.* 70, 805-38(1929).—When root systems of *Helianthus*, *Ricinus* and *Phaseolus* were severed just above the crown and were then placed in solns. of glucose or $NaNO_3$, the flow of H_2O was reversed; i. e., passing from crown to root tips. *Helianthus* required a soln. of an osmotic value of 7.5 to 10 atm. to produce a reversed flow of H_2O equiv. to that of a normal upward transpiring stream. The rate of flow increased with an increasing concn. of solute, but it was not directly proportional. Bleeding from the crown of the root system ceased when the roots were transferred from H_2O to a soln. of glucose having an osmotic value of 1.4 to 4.2 atm., but the bleeding increased beyond its original value when the roots were returned to H_2O . Resistance to flow of H_2O (filtration resistance) was reduced greatly ($1/10$ to $1/30$) when the roots were killed.

A. E. HITCHCOCK

Additional results with the phytoserological method. OTTO MORITZ. *Planta Abt. E Z. wiss. Biol.* 7, 759-813(1929).—Generic and sp. differences in plants were distinguished serologically, making use of an anaphylactic reaction with uterus muscle of the guinea pig. The pptn. ring method was also used. Parents of a hybrid could likewise be identified by this method. Dale's app. (cf. *C. A.* 7, 1381), with slight modifications, was used in making the anaphylactic tests. A detailed discussion is given of the literature on serological investigations.

A. E. HITCHCOCK

Quantitative enzyme studies on Mendelian factors. HANS VON EULER AND HARALD NILSSON. *Naturwissenschaften* 17, 289-90(1929).—The catalase content in the individuals of the offspring of a barley bastard follows the Mendelian rules as to distribution (1:3). The av. H_2O_2 decompn. velocity was $k \times 10^3 = 31$ for the green individuals and 11 for the white ones (green dominated).

B. J. C. VAN DER HORVEN

Pigments of red algae. R. LEMBERG. *Naturwissenschaften* 17, 541(1929).—The pigments phycoerythrin and phycocyanins were studied. The pepsin cleavage is unsatisfactory for isolation of the colored component from the protein; extn. with $CHCl_3$

of the dil. soln. resulting from cleavage with strong HCl excluding air was successful. The phycoerythrin dye is oxidized easily by air in acid soln., also by FeCl_3 yielding the phycocyan dye. The dye component of phycocyan was prep'd. from "Nori," a Japanese delicacy (prep'd. from Bangiaceae), in cryst. form; the phycoerythrin dye could not be obtained quite so pure. The dye substances are termed phycobillins; they are amphoteric, rather strongly acid and easily esterified. They form salts with HCl in CHCl_3 , hydrolyzed in water. In org. solvents sol. complex salts with Zn or Cu are easily formed, the former being strongly fluorescent. The phyco cyanobillin is spectrally quite similar to bilicyanin, the phycoerythrobillin with urobilin. Several indications for oxypyrrrole rings are present. Phycocyanobillin crystd. from $\text{CHCl}_3\text{-C}_6\text{H}_6$ in CO_2 in deep blue prisms with red luster; analysis $\text{C}_{44}\text{H}_{44}\text{O}_6\text{N}_4$, 2 carboxyl groups; it occurs to 2% in the chromoproteid. The substances are considered as derivs. from chlorophyll.

B. J. C. VAN DER HOEVEN

Cotton seeds: their absorption of water and specific gravity. A. JAMES TURNER. *Agr. J. India* 24, 83-90(1929).—Sp. gr. detns. on cotton seed by the water-displacement method are inaccurate because of the rapid initial absorption of water by the seed. Delinted cotton seed do not absorb liquid paraffin. By using this material as a liquid to be displaced, the sp. gravities of small, medium and large seeds of Punjab-American 4F cotton, compared with water at 78° F., were 1.064, 1.078 and 1.069, resp. Because of changes in the moisture content of the seed the gravities observed vary with the temp. and humidity at which the seed have been stored.

K. D. JACOB

Effects of hydrogen-ion concentrations on rice cultures. S. K. MITRA AND L. N. PHUKAN. *Agr. J. India* 24, 109-16(1929).—Rice plants were grown in Knop's nutrient soln., the p_H values of which ranged from 3.0 to 8.4, adjustment of the H-ion concn. being obtained by addn. of HCl or NaOH. As indicated by root growth, solns. at p_H 3.3 were extremely toxic and those at p_H 3.9 were distinctly toxic. Development of roots was below normal at p_H values up to 6.6, but was quite satisfactory at higher values. The best root growth was obtained at p_H 7.9.

K. D. JACOB

Annotated bibliography on the storage of cotton seed and of seed cotton. HENRY M. STERCE. *Agr. J. India* 24, 127-34(1929).—This is a list of 25 papers, accompanied by brief abstrs., dealing principally with the chem. changes occurring in cotton seed during storage under various conditions.

K. D. JACOB

Studies on the nature of rust resistance in wheat. I. General introduction. II. Physicochemical properties of host-cell contents. III. Culture and injection experiments to demonstrate inhibiting or accessory substances. R. NEWTON, J. V. LEHMANN AND A. E. CLARKE. *Can. J. Research* 1, No. 1, 5-35(1929).—A program of investigations is outlined and the results of the first 3 years' work are reported. Eight varieties of wheat, differing widely in resistance to stem rust, showed no corresponding differences in the physicochem. properties of their expressed tissue-fluids. The infection of susceptible varieties was in some cases reduced by administering exts. of resistant varieties in Petri-dish cultures or by direct injection into inoculated leaves. The injection of the juice of infected leaves into healthy leaves failed to demonstrate the presence of any toxin excreted by the fungus. The injection of salicylic acid, catechol or vanillin in suitable concns. frequently caused a reduction in infection. These compds. in very low concns. stimulated the growth of *Helminthosporium sativum*, but at higher concns. inhibited it. The same phenolic compds. inhibited the germination of rust spores. On filtered wheat juice rust spores also failed to germinate, though on unfiltered juice they germinated normally. A bibliography of 79 references is appended.

IV. Phenolic compounds of the wheat plant. R. NEWTON AND J. A. ANDERSON. *Ibid* 86-99.—Rust resistance in wheat may be due to the liberation of phenols in the host cell upon the entrance of the fungus. A tentative method is outlined for detg. phenolic compds. in wheat press juice, including a critical study of the conditions for clarifying the juice with tungstic acid. The content of phenolic substance in wheat varieties bears some relation to rust resistance, in general, the most resistant varieties contg. the highest percentages of phenolic compds. while the least resistant varieties contain the smallest. Yellow pigments of the flavone type seemed to be the principal phenolic compds. present. These are being investigated further. A bibliography of 32 references is appended.

K. D. JACOB

The carbohydrate content of detached, partially shaded leaves. R. GANE. *Proc. Leeds Phil. Lit. Soc. Sci. Sect.* 1, Pt. 10, 497-505(1929).—Starch, sucrose and reducing substances were detd. in the distal, median and proximal portions of leaves of *Plantago media* and *Scolopendrium vulgare*, the median portions being shaded while the rest of the leaf was exposed to light. Differences in the sugar content then found in the leaf seemed to be assoc. with the shading but the differences did not seem adequate to ex-

plain the complete failure of starch to appear in the shaded strip. The distribution of sugars in leaves of *Plantago media* thus treated, and in those in which the main veins had been removed, indicated that sugars can still move into the shaded region from illuminated ones in spite of the dislocation of the vein system. K. D. JACOB

Growth of yeasts and molds at the expense of ammonia and alcohol vapors. P. LINDNER. *Wochschr. Brau.* 46, 283-4(1929).—The results of the expts. are difficult to reconcile with the theory that "Bios" is necessary for yeast growth. They show that sugar itself is not essential for growth, but confirm the conclusion of P. Thomas that yeasts like green plants are able to form the nitrogenous substances of their protoplasm from NH_3 and ternary products which are closely related to sugar. L. has previously shown that larger yeast crops can be obtained from alc. solns. than from sugar solns. of the same concn. Many molds can develop in a very healthy and vigorous condition at the expense of NH_3 and alc. vapors. S. JÓZSA

Studies on the fermentation products by mold fungi. V. *Dematium pullulans*. YUSUKE SUMIKI. *J. Agr. Chem. Soc. Japan* 5, 576-80; *Bull. Agr. Chem. Soc. Japan* 5, 14-6(1929).—*Dematium pullulans*, pure cultured, was inoculated in the medium (glucose 7.2, peptone 0.1 or $(\text{NH}_4)_2\text{SO}_4$ 1.0, K_2HPO_4 0.05, MgSO_4 0.01, CaCl_2 0.01%, FeCl_3 and NaCl trace) and cultivated at 30° for several weeks. From this fermented medium EtOH, AcH, succinic acid and *dl*-lactic acid were isolated and identified. The quantities of the fermented products were very small and a greater part of the glucose was not consumed. The max. yields of EtOH and acids from 7.2 g. of glucose were 0.98 wt. % and 0.27%, resp. K. KAMBE

Chemical analysis of the oleoresins as a means of distinguishing Jeffrey pine and western yellow pine. N. T. MIROV. *J. Forestry* 27, 176-87(1929).—In non-typical trees it is often difficult to distinguish *P. jeffryi* from *P. ponderosa* by their morphological characters. The oleoresins from the wood of these species are very different in chem. compn. The oleoresin from the former consists chiefly of heptane, no terpenes being present, whereas *ponderosa* oleoresin is mostly a mixt. of terpenes. The relation between cross-varieties and oleoresin compn. is discussed. A. L. KAMMERER

Cyanogenetic glucosides in Australian plants. HORACE FINNEMORE AND CHARLES BERTRAM COX. *J. Proc. Roy. Soc. N. S. Wales* 62, 369-78(1929).—A glucoside identified as sambunigrin by analysis and sp. rotation detns. on the substance and its Ac derivs. was isolated from *Acacia glaucescens* and *Acacia cheeli*, Blakeley. The amt. of HCN in 11 species of *Euphorbia drummondii* varied from 0.041 to 0.103%. *Goodia lotifolia* collected in August contained 0.23% HCN and numerous samples of *Poranthera microphylla* gave pos. tests for HCN. A specimen of *Eucalyptus corynocalyx* yielded 0.179% of HCN. H. R. KRAYBILL

Relationship of chlorophyll to the porphyrins. J. B. CONANT AND J. F. HYDE. *Science* 70, 149(1929).—The Mg-free chlorophyll derivs. (the phaeophorbides, phytochlorin e and phytorhodin g) differ from typical porphyrins as follows: (1) In dil. alk. soln. they are reduced by Na hyposulfite and by H in the presence of palladinized asbestos. (2) Catalytic hydrogenation in glacial AcOH yields colorless solns. with the absorption of 3 or 4 moles of H; on exposure to air reoxidation occurs but the product is different from the original material. The porphyrin structure represents a more stable and less reactive grouping of unsatd. linkages and pyrrole nuclei than are present in the chlorophylls. The phaeophorbides, phytochlorin e and phytorhodin g lose CO_2 and H_2O at 150 - 250° in diphenyl. The loss of CO_2 cannot be from a free $-\text{COOH}$. It is suggested that a lactone linkage is responsible for part of the formation of CO_2 and that the C skeleton of the porphyrins is modified in chlorophyll by the presence of 1 or more OH and COOH groups on the atoms connecting the pyrrole nuclei. H. R. KRAYBILL

The ecology of growing beets with respect to disease. V. STEHLIK AND FR. NEUWIRTH. *Listy Cukrovar.* 47, 729-35(1929); cf. C. A. 23, 4765.—The retention of the germinating power is influenced by storage of the seeds. The intensity of respiration and a loss of reserve matter are detd. by such influence as the H_2O content of the seeds, of the air, temp., light, and the presence of O. An increase in the H_2O content of the seed increases the intensity of the respiration. Drying to about 15% moisture is advised to maintain the seed at const. wt. and germinating power, but not as a measure for preventing the blight. Various methods for removing the hard shell which forms on seeds may result in germination so rapid that the infection by *Phoma betae* is outgrown. Disinfecting powers have been erroneously ascribed to these treatments. FRANK MARKEŠ

Analyses of *Leucaena glauca*, *Hibiscus oculentus*, *Moringa pterygosperma* and *limyama*. A. W. R. JOACHIM. *Trop. Agr. (Ceylon)* 72, 279-80(1929). A. L. MARIANO

Nitrogen content and nitrogen distribution in legumes during the period of growth on the basis of comparative investigations. HANS WOZAK. *Fortschr. Landw.* 4, 485-8 (1929).—Nodules, roots, and tops of lupines, red clover, horse beans, vetch, peas, alfalfa, and bush beans from pot cultures and field plots were analyzed for total N at various stages of growth. Results are presented from the viewpoint of efficiency in N assimilation. LAWRENCE P. MILLER

The chlorophyllous assimilation of carbon dioxide by green leaves in an electric field. D. CHOUCIAK. *Rev. gén. botan.* 41, 465-8(1929).—By means of a specially constructed app. C. found that corn leaves and leaves of *Casuarina equisetifolia* assimilate larger amts. of CO₂ when charged positively than when charged negatively or when without charge. Respiration in darkness was not affected under similar conditions. LAWRENCE P. MILLER

Marine algae and colloids (algine, demineralized algae, marine grasses). MAURICE DESCHIENS. *Rev. gén. colloïdes* 7, 206-19(1929).—D. discusses the following: (1) Algine: Properties, history, patents, exptl. work done, industrial prepn., manuf. of alginates, plastic materials, industrial applications of alginates. (2) Demineralized algae. (3) Marine grasses: Uses, prepn., paper and celluloses. (4) Statistics on the production of algae. A. J. MONACK

Further experiments on the chemistry of angiosperm seeds and the external factors, both natural and artificial, for germination. IV. Studies on the dye and salt permeability of fruit and seed shells. ANNELIESE NIETHAMMER. *Biochem. Z.* 209, 263-75(1929); cf. C. A. 23, 183.—Under primary stimuli N. distinguishes those agencies which can penetrate and at the same time influence the permeability. HCN, certain aldehydes, saponins, thiocyanates and ether act in this manner. S. M.

The transformation of acetaldehyde in higher plants. J. BODNAR AND CLARA BERNAUER. *Biochem. Z.* 209, 458-70(1929).—Pea meal transforms AcH very energetically, but in meal kept with AcH for some time no AcOH was found. Similar results were obtained also with other plants. It seems probable therefore that they do not contain an enzyme which transforms AcH according to Cannizzaro's reaction. The pea meal does not form EtOH from the added AcH though it does reduce the nascent aldehyde to alc. The meal changes added AcH by aldol condensation; this, however, is not an enzymic process as it takes place also with meal which had been previously heated. S. MORGULIS

The effect of iodide ions on the growth and cell multiplication in halophytes. JULIUS STOKLASA. *Biochem. Z.* 211, 213-28(1929).—Seeds of the sugar beet were treated for 6 hrs. with a nutritive soln. contg. 0.05 g. I in the form of KI. The embryos of seeds so treated manifest a greater vigor than those from untreated seeds. They showed a more rapid process of germination, of formation of chlorophyll organs and protoplasm and a more rapid resorption of org. compds. Furthermore the seedlings were much larger and showed a more luxuriant development. Besides the I₂-treated plants contain both in the leaves and in the roots much larger amts. of furfurole. Furthermore, hyperiodization always led to a great accumulation of furfuroids, so that in those which developed poorly and many of which died a 9-10% furfurole content was found. S. MORGULIS

The concentration effect in *Nitella*. W. J. V. OSTERHOUT AND E. S. HARRIS. *J. Gen. Physiol.* 12, 761-81(1929).—Studies on the concn. of KCl on the living protoplasm of *Nitella* show that when the p. d. is plotted as ordinate and the log of concn. as abscissa a straight-line graph demanded by the theory is not obtained but rather one with less slope and somewhat concave to the axis of the abscissas. With dil. solns. of a variety of salts, the cation has greater mobility in the protoplasm than the anion or the partition coeff. of the cation increases faster with increasing concn. than that of the anion. In either case the increase in concn. may be accompanied by an increase or a decrease in the relative amt. of salt taken up by the protoplasm. Theoretically the sign of the dil. soln. need bear no relation to the relative amt. of salt taken up under these conditions. Assuming that the p. d. represents chem. effect, the chem. effect of the protoplasm is much greater than that of the cell wall. Methods are described. C. H. RICHARDSON

The effect of sudden changes of temperature on protoplasmic streaming. S. F. COOK. *J. Gen. Physiol.* 12, 793-803(1929).—A sudden fall of 15-20° stops protoplasmic streaming in *Nitella*. Recovery of normal streaming follows a definite course, the time being dependent on the temp. Inhibition of streaming has a physical basis inherent in the structure of protoplasm. C. H. RICHARDSON

The regulation of the pH through succulent tissue. VLADIMIR ULBRICH. *Protoplasma* 3, 469-506(1928).—Slices of *Opuntia phaeacantha* shoots were placed in dil.

KOH, and the changes in the p_H of the soln. under the influence of the tissue and the imbibition of the tissue under the influence of the solns. were noted. The p_H of the soln. was brought toward an equil. value of 5.6. Nothing came out of the cells in the acid soln. except CO_2 . The imbibition of the living cell depended on the p_H of the medium. It was probable that the cell surfaces adsorbed substances from the soln. which altered the permeability of the surfaces so that certain cell contents escaped and played a part in the regulating of the p_H of the external soln. M. H. SOULÉ

The permeability of protoplasm. V. S. IL'IN. *Protoplasma* 3, 558-602(1928).—The carbohydrate contents of the cells of *Allium cepa* and other plants were altered when the cells were placed in aq. or salt soln. primarily because of their exosmosis into the external soln. Frequently as much as 2% of the wet wt. of the tissue passed out. The protoplasm was permeable to different sugars such as fructose, glucose, saccharose and inulin. In the presence of low concns. of such salts as NaCl, KCl, $MgCl_2$, $CaCl_2$, $MnCl_2$, Na_2HPO_4 and KH_2PO_4 the permeability was diminished. With hypertonic solns. of these salts a high permeability was observed. The permeability diminished at first, then ascended suddenly when the cells were passed from acid through neutral to alk. reaction. M. H. SOULÉ

Hydrocyanic acid in Papilionaceae—Loteae. PAUL GUÉRIN. *Compt. rend.* 189, 115-6(1929); cf. C. A. 23, 1664.—In the genera *Tetragonolobus*, *Dorycnium*, and *Bonjeania* and in certain members of the genus *Lotus* a cyanogenetic principle which does not exist in the seed appears on germination in the cotyledonous leaves. In *Lotus*, this principle, when present in the cotyledonous leaves, also appears in the leaves and stems. In the other 3 genera, HCN is not found in any subsequently formed parts although the cotyledonous leaves will continue to give a test for HCN during the whole course of vegetation. J. T. SULLIVAN

The toxic substance produced by the eye-spot fungus of sugar cane, *Helminthosporium sacchari* Butler. H. ATHERTON LEE. *Plant Physiology* 4, 193-212(1929).—Apparently the toxic factor is the nitrite ion which is produced by the pathogen from the inorg. nitrates present in the medium or other environment. WALTER THOMAS

The extraction of nitrogenous materials from pear tissues. F. B. LINCOLN AND A. S. MULAY. *Plant Physiology* 4, 233-50(1929).—When preservation of tissues is necessary in N partition investigations, dehydration at 50-55° (C. A. 22, 1994) or storage at 0-7° for short periods, or freezing (-27°) will give results quite similar to those on fresh tissues. Acid (p_H 1.0) was found to be a suitable pptg. agent in the detn. of the colloidal proteins in the exts. Of the leaf N 98.4% was obtained by first extg. with 70% hot alc. contg. 1% acid, followed by extn. with NaOH for 3 days at 40°. The expressed sap of pear wood contains 3 times as much N as the bark, but the protein N content is nearly the same in both. Nearly half of the N of the wood is polypeptide N, whereas the bark is relatively low in this form of N but high in diamino N and very high in monoamino N and amide N. WALTER THOMAS

Hemicellulose as a storage carbohydrate in woody plants, with special reference to the apple. A. E. MURNEEK. *Plant Physiology* 4, 251-64(1929).—A review of our present knowledge of the occurrence, distribution, and chemistry of hemicellulose in some higher plants, with special reference to woody plants. Hemicellulose is an important reserve carbohydrate. Future investigations should deal with the chem. constitution and metabolic role of each constituent of this group. A bibliography accompanies the paper. WALTER THOMAS

Identification of certain species of citrus by colorimetric tests. F. F. HALMA AND A. R. C. HAAS. *Plant Physiology* 4, 265-8(1929).—A description of chem. methods that have proved successful in detg. the selection of stocks of citrus which are congenial with the scion variety. WALTER THOMAS

A simple method for nitrate nitrogen determination in wheat plants. H. F. HOLTZ AND CARL LARSON. *Plant Physiology* 4, 288-91(1929).—A modification of the method used by Harper (C. A. 18, 725) for clarifying the exts. is described. Two-tenths g. of the powd. dry plant material is extd. with 74 cc. H_2O for 1 hr. Satd. Ag_2SO_4 is added, followed by 1 cc. $N CuSO_4$, 0.2 g. $Ca(OH)_2$, and 2-3 g. carbon black. Nitrates are detd. in the filtered ext. by the phenoldisulfonic acid method. WALTER THOMAS

Titanium in the cryptogamic plants. GABRIEL BERTRAND AND C. VORONCA-SPINT. *Compt. rend.* 189, 73-4(1929); cf. C. A. 23, 3952.—Examn. of ferns, algae and fungi by the authors' method leads to the conclusion that generally Ti is present in the cryptogamic plants as in the phanerogamic ones. There are, however, species of fungi in which the proportion of Ti to fresh weight is so small, probably 0.1 and less of the ordinary, that definite colorimetric estn. is not possible. G. TOMAZIUS

Cinnamon (REDGROVE) 17. Gentian (REDGROVE) 17. Chlorophyll. IV. Degradation of chlorophyll by alkalis (TREIBS, WIEDEMANN) 10. Isolation of mesaconic acid from cabbage leaves (BUSTON) 10. Bituminous materials for tree surgery (U. S. pat. 1,726,708) 22.

FISCHER, HUGO: *Tabulae biologicae*. Bd. 5. Suppl. 1. Kohlensäure-Assimilation der grünen Pflanzen unter verschiedenen Bedingungen, namentlich Wirkg. von Kohlensäure-Gaben u. Licht-Stärke. Berlin: W. Junk. Pp. 316-62. M. 6.

Handbuch der biologischen Arbeitsmethoden. Edited by EMIL ABDERHALDEN. Abt. 1. Chemische, physikalisch-chemische Methoden zur Untersuchung des Bodens und der Pflanze. Tl 4, H. 1 (Lfg. 300). Ernährung u. Stoffwechsel d. Pflanzen. FRIEDRICH HUSTEDT: Vom Sammeln u. Präparieren d. Kieselalgen sowie Angaben über Untersuchungs- u. Kulturmethoden. HANS GAFFRON: Methoden zur Untersuchung der Kohlensäureassimilation. WALTER KOTTE: Methoden zum Nachweis pflanzlicher Wundhormone. G. STALFEDT: Neuere Methoden zur Ermittlung des Öffnungszustandes der Stomata. Berlin and Vienna: Urban & Schwarzenberg. Pp. 999-1011.

E—NUTRITION

PHILIP B. HAWK

The influence of fresh fruit and berries on the secretion of the stomach. H. J. GRÜNBERG. *Arch. Verdauungs-Krankh.* 44, 123-32(1928).—One set of fruits (mellons, blue grapes, black plums, cherries, pears, peaches, oranges) produces, after a short latent period, secretion with marked acidity and low enzyme content. Another group of fruits (bird cherries, gooseberries, French plums, green grapes, raspberries and apricots) produces, after a longer latent period, secretion of low acidity and marked enzyme content. F. K.

Alimentary value of legumes on albino rats. A. GALAMINI. *Atti accad. Lincei* 9, 809-11(1929).—Rats fed with raw white beans died within a few days, having lost 40% of weight even when vitamins were added. With cooked white beans alone, one rat lived 68 days; with vitamins added one lasted 108 days. When white of egg was added a slight gain in wt. was noted. A. W. CONTIERI

The biological effect of ultra-violet radiation of fats and chocolate. O. RIED. *Wiener klin. Wochschr.* 42, 896-8(1929).—Irradiated chocolate on sale by a Vienna firm has an improved flavor and contains a considerable amt. of vitamin D as shown by animal feeding expts. D. B. DILL

Improvements in the method of isolating the anti-beriberi vitamin. B. C. P. JANSEN. *Rec. trav. chim.* 48, 984-5(1929).—Since histidine and histamine are substances of great physiol. importance, it might be expected that the anti-beriberi vitamin, isolated by J. and Donath (*C. A.* 21, 2150), $C_8H_{10}ON_2$, would have the formula $C_8H_9N_2 \cdot CH_2 \cdot CH(OH)Me$. This substance should be relatively easily obtained from histidine by first of all replacing the NH_2 group by OH and then reducing the COH group. Attempts made in this direction along with Donath, however, have afforded products without anti-beriberi action. The yield of crystd. vitamin from rice bran may be doubled by following the same procedure as described previously, but the phosphotungstic acid is replaced by silicotungstic acid and the alc. H_2PtCl_6 by $CdCl_2$ in abs. EtOH, care being taken that the vol. of the alc. soln. contg. the vitamin from 100 kg. rice bran does not exceed 500 cc. In this way it was possible to obtain 3 g. of material from 100 kg. rice bran, which, from tests on animals, contains about 25% vitamin; the previous method of working afforded about 1.5 g. of similar material. C. F. VAN DUIN

The vitamin C content of cucumbers and cucumber pickles. B. H. THURMAN AND H. W. VAHLTRICE. *J. Home Econ.* 21, 510-3(1929).—Guinea pigs fed on fresh cucumbers and fresh cucumber pickles of the bread and butter type were protected against scurvy, the pickles apparently having the same antiscorbutic potency as fresh cucumbers. Pickles made from salt stock cucumbers failed to protect from scurvy. L. D. ELLIOTT

Green tea as a source of vitamin C. HAZEL E. MUNSSELL AND HILDA BLACK KIPER. *J. Home Econ.* 21, 514-8(1929).—Feeding expts. with guinea pigs proved that contrary to the manufacturer's statement on the label a Japan green tea was not "rich in vitamin C." Whereas 2 cc. of orange juice daily furnished sufficient vitamin C to enable the guinea pigs to make nearly normal growth, 15 cc. of tea infusion did not result in significant gains in wt. and furthermore the scurvy symptoms in the animals fed tea were in all cases as severe as those of negative controls. L. D. ELLIOTT

Vitamin A content of the green and white leaves of market head lettuce. MARTHA M. KRAMER, GLADYS BOEHM, AND RUTH ESTHER WILLIAMS. *J. Home Econ.* 21, 679-80(1929).—Expts. with rats showed that the dark green outer leaves of a Calif. head lettuce contained 30 or more times as much vitamin A as equal wts. of the white leaves from the center of the same heads. L. D. ELLIOTT

The water-soluble vitamins B and their utilization in the treatment of pulmonary tuberculosis. R. LÉCOQ. *Pharm. Française* 31, Mar., 1927; *Rev. hyg. méd. prév.* 51, 526.—Beer yeast ext. sensitized with Mn is an excellent addn. to the diet of the tuberculous. Results were very marked after only 1 week of treatment. Nutrition was particularly benefited. Sensitized yeast is recommended as a valuable accessory to the regular treatment. C. R. F.

Isolation of the antineuritic vitamin. ASHUTOSH MUKHERJI. *Indian Med. Gaz.* 64, 443-5(1929).—A solid cryst. antineuritic residue from rice polishings has been isolated. FREDERICK G. GERMUTH

Distribution of vitamin B₂ in certain foods. WALLACE R. AVEKROYD AND MARGARET H. ROSCOE. *Biochem. J.* 23, 483-97(1929).—Using the Chick and Roscoe method for estg. vitamin B₂ (*C. A.* 22, 4588) the authors found that the vitamin B₂ value of wheat, maize and dried peas is poor, whereas that of ox liver, yeast and fresh whole milk is excellent. BENJAMIN HARROW

A method for the assay of the antineuritic vitamin B₂ in which the growth of young rats is used as a criterion. HARRIETTE CHICK AND MARGARET H. ROSCOE. *Biochem. J.* 23, 498-503(1929).—Fresh egg white is rich in vitamin B₂ but is devoid of vitamin B₁. Yeast autoclaved at 120° for 5 hrs. is suitable for vitamin B₂ expts. B. H.

An attempt to separate vitamin B₂ from vitamin B in yeast and a comparison of its properties with those of the antineuritic vitamin B₁. HARRIETTE CHICK AND MARGARET H. ROSCOE. *Biochem. J.* 23, 504-13(1929).—Vitamin B₂ is insol. and vitamin B₁ is sol. in alc. of 92% by weight. With Peters' method (*C. A.* 22, 447), about 1/2 to 3/4 of the vitamin B₂ present in the original yeast is carried down in the pptn. with Pb acetate at pH 4.7. BENJAMIN HARROW

Experiments on nutrition. IX. Comparative vitamin B values of foodstuffs. Pulses and nuts. ROBERT H. A. PLIMMER, WM. H. RAYMOND AND JOHN LOWNDES. *Biochem. J.* 23, 546-57(1929); cf. *C. A.* 22, 614.

Material	Percentage amount in diet for maintenance	Relative vitamin B value
Dried yeast	4	100
Split peas	30	13
Whole dried green peas	30	13
Lentils	30	13
Haricot beans	40	10
Soy beans	30	13
Peanuts	20	20
Ground almonds	40	10
Whole almonds	40	10
Hazel nuts	20	20
Coconut	No maintenance	0

BENJAMIN HARROW

Further observations of the effects of large doses of irradiated ergosterol. JOHN C. HOYLE AND HARRY BUCKLAND. *Biochem. J.* 23, 58-65(1929).—A confirmation of the results of Dixon and Hoyle (*British Med. J.* 1928, II, 835). In no case did the irradiated ergosterol administered prove fatal to the animals. All the animals showed a persistent diuresis without any significant increase in either the total phosphate or chloride output in the urine. BENJAMIN HARROW

Vitamin B content of the polished rice koji. RYOHEI TAKATA. *Chem. News* 139, 137(1929).—Koji is formed from cereals on which *Aspergillus oryzae* is grown. When used as the sole source of the growth-promoting factor for rats, and when used as the sole source of the antineuritic factor for pigeons, it was better than polished rice. This indicates that the organism can synthesize these vitamins. AMY LEVESCONTE

Heat and ultra-violet irradiation as means of differentiating vitamins B and G in yeast. CORNELIA KENNEDY AND LEROY S. PALMER. *J. Biol. Chem.* 83, 493-6(1929).—Irradiation cannot be relied upon completely to destroy the growth-promoting factors of yeast other than the antineuritic factor. It is evident, however, that irradiation and autoclaving impair in varying degrees both vitamins B and G. These results do not substantiate those of Hogan and Hunter (*C. A.* 22, 3432). A. P. LOTHEOP

Quantitative studies of responses to different intakes of vitamin D. H. C. SHEARMAN AND H. K. STIEBELING. *J. Biol. Chem.* 83, 497-504(1929).—In young rats reared by mothers on a diet consisting largely of $\frac{2}{3}$ ground whole wheat and $\frac{1}{3}$ whole milk powder, and transferred at the 21st or 28th day to a diet decidedly deficient in vitamin D, but adequate in other respects, practically normal calcification resulted by the 56th day of age in cases in which the basal diet had been supplemented by somewhat more than 5% of the calcs. from whole (summer) milk powder and by the 80th day in cases in which the basal diet had been supplemented during the preceding 4 weeks by the same milk powder to the extent of 8-9% of the cal. Smaller graded portions of milk produced corresponding improvements in calcification over their resp. neg. controls. The large no. of expts. afford extensive and convincing evidence in confirmation of the fact that cow milk as ordinarily produced in this country contains important amts. of vitamin D. As consistent responses in calcification were obtained when the exptl. period followed immediately upon sepn. of the young from their mothers as when it was preceded by prolonged feeding of the vitamin-D deficient diet. This procedure insures vigorous animals and permits the 4 or 5 week exptl. period to be terminated at an early age, thus making use of the period of most rapid deposition of Ca as well as reducing the time and expense involved in exptl. work. The % of Ca in the fresh femur is proportional to the supplementary vitamin D furnished within a sufficient range of values to permit of reasonably quant. comparisons, when sufficient nos. of well controlled expts. are performed.

A. P. LOTHROP

Polished rice and sunflower seeds as diets for the study of avian beriberi. R. REITANO AND G. SANFILIPPO. *Boll. soc. ital. biol. sper.* 4, 510-5(1929).—Di Mattei's findings were confirmed. Two g. per day of sunflower seeds administered to pigeons kept on a diet of polished rice is sufficient to render the birds apparently normal with the exception of polyneuritic symptoms. There was no vomiting or loss of wt.

PETER MASUCCI

The suprarenal glands and the testicles in pigeons kept on a diet of polished rice and sunflower seeds. R. REITANO AND G. SANFILIPPO. *Boll. soc. ital. biol. sper.* 4, 515-8(1929).—Pigeons kept on a diet of 25 g. polished rice and 2 g. peeled sunflower seeds per day failed to show atrophy of the suprarenals. This indicates that the phenomena of polyneuritis and atrophy of the suprarenals in pigeons are not necessarily concomitant. The addn. of 2 g. per day of sunflower seeds to the polished rice diet rendered the birds normal from the sexual standpoint. Post-mortem examn. showed no atrophy of the testicles.

PETER MASUCCI

The action of vegetable juice on the gastric secretion. WITOLD ORLOWSKI. *Ann. med.* 23, 523-44(1928).—See C. A. 23, 3266.

A. E. MEYER

The biologic action of irradiated ergosterol. G. E. GHIRARDI. *Biochem. therap. sper.* 16, 241-53(1929).—Daily doses of 10 mg. of irradiated ergosterol (Vitaldol Lepetit) produce in normal children of less than 5 years a considerable increase of inorg. P in the serum and an insignificant reduction of the Ca. In children of 7-8 years no effect was observed. Young children are more sensitive to the action of irradiated ergosterol.

A. E. MEYER

The experimental hypervitaminosis D. J. A. COLLAZO, B. VARELA FUENTES AND P. RUBINO. *Rev. assoc. med. Argent.* 41, No. 273-4(1928); *Rev. sudamericana endocrinol. inmunol. quimioterap.* 12, 591(1929).—Excessive doses of irradiated ergosterol and of cod-liver oil produce in rats premature calcification of the cartilage of the joints, calcification of the main arteries, nephritis and diffuse calciosis and tumors in the wall of the stomach.

A. E. MEYER

Vitamin action and surface tension activity. III. Studies on the parallel changes of the antiscorbutic effect and of the surface tension activity of cabbage juice. N. E. SHEPIL'EVSKII. *Biochem. Z.* 210, 334-47(1929); cf. C. A. 23, 3959.—A parallelism between surface tension activity and antiscorbutic action is denied. S. MOROULIS

Experimental therapeutic studies on females with spontaneous cycle insufficiency. III. Treatment by dietary measures. S. LOEWY AND H. E. VOSS. *Endokrinologie* 3, 343-60(1929).—A diet consisting of oats only causes estrus insufficiency in albino rats. Through the addn. to this basic oat diet of rye bread or of Promonta relief could be induced particularly with the latter.

S. MOROULIS

The protein requirements of dairy cows. ISTVAN WEISSER. *Proc. 8th World's Dairy Congress* 1928, 26-9.—In feeding expts. on 10 cows lasting over 3 consecutive 30-day periods, lowering the digestible protein per day per cow from 1.584 kg. to 0.871 kg., while the starch equiv. was increased from 6.87 to 7.14 kg. had practically no effect on the yield of milk. This was equiv. to a reduction of digestible proteins from 98.73 g. to 43.20 g. per kg. of milk. This reduction was undoubtedly partly com-

compensated for by the administration of 228 g. of extra amides present in turnip fodder. The results agree with the min. requirements stated by A. Buschmann (0.225 kg. digestible protein per 500 kg. live wt. and 20–5% albumin over and above the quantity secreted in the milk) rather than those of O. Kellner (0.5 kg. and 60 g. per kg. of milk).

A. PAPINEAU-COUTURE

Some of the effects produced on the richness of cow milk by feeding cod-liver oil. JOHN GOLDING. *Proc. 8th World's Dairy Congress* 1928, 44–9.—The growth-promotion property of milk, assocd. with the vitamin-A content, can be increased 10-fold as compared with a basal ration of straw, mangolds and selected concentrates. Its antirachitic properties assocd. with vitamin D can also be increased to a marked degree as compared with a similar control ration. The fat content of milk can be reduced by feeding more than 4–6 oz. of cod-liver oil per cow per day. No such fat reduction was produced when the unsaponifiable fraction of cod-liver oil (equiv. to 8 oz. of oil) was fed in soln. in peanut oil, nor when a com. prepn. of the vitamin fraction of cod-liver oil was fed in the same way.

A. PAPINEAU-COUTURE

Calcium and phosphorus in the metabolism of the lactating animal and factors that influence their assimilation. J. B. ORR AND H. E. MAGEE. *Proc. 8th World's Dairy Congress* 1928, 42–4.—A brief discussion.

A. PAPINEAU-COUTURE

The safety factor of pasteurized milk. H. C. CORRY MANN. *Proc. 8th World's Dairy Congress* 1928, 127–33.—Observations at the Evelina Hospital for children, at London, led to the following conclusions: (1) Milk which has been pasteurized by the low-temp. holder process (145° F. for 30 min.) is not damaged as milk food for infants. (2) No incidence of scurvy was observed over 3 yrs.' time in children under 2 yrs. which were given low-temp. pasteurized milk without a ration of orange juice; no increase in growth rate and no improvement in nutrition was ever noted from the addn. of orange juice to a diet of milk pasteurized by this method. Exptl. work extending over 4 yrs. has shown that a ration of pasteurized milk caused a very marked improvement in the nutrition of boys of school age when added to a basic diet which was poor in vitamins A, C and D, indicating that the vitamin value of the raw milk was undamaged by low-temp. pasteurization.

A. PAPINEAU-COUTURE

The action of ultra-violet light and x-rays on the spectrum of pure and activated ergosterol. R. R. MORRISON AND L. H. CLARK. *Brit. J. Radiology* 2, 307–15 (1929).—When ergosterol in alc. soln. is irradiated with ultra-violet light in an atm. of N the absorption spectrum changes in a complicated way. With small doses of radiation there is increased absorption, which reaches a max. for 15–30 min. exposure under the exptl. conditions, and then decreases with further increase in the time of irradiation. When the exposures are made in an atm. of O, the characteristic band of ergosterol first expands slightly and then contracts. Spectra of samples of irradiated ergosterol which have been dried in air extend much further into the ultra-violet than those which have not been dried. No such change on drying occurs in unirradiated material. Drying in pure N produced no effect. The extension of the spectrum produced by heavy irradiation with ultra-violet light is greater in an atm. of O than in N or A. This extension forms no criterion of vitamin-D activity. The spectrum shows no change as the result of being irradiated with x-rays.

E. H. QUIMBY

Nutritional studies of the "Miso-Preparation." R. TAKATA. *J. Soc. Chem. Ind. (Japan)* 31, 811–20, 983–9 (1928); 32, 495–7 (1929); Suppl. Binding 31, 196–9, 233–4B (1928); 32, 154B (1929).—"Miso" (a fermented soy-bean product) has less food value than the original soy bean on account of deficiency in cystine. Soy bean contains 0.32% of cystine. Some of the vitamin B contained in soy bean is destroyed.

TOMODA

Evolution of avitaminosis B of pigeons caused by insufficient albumin nutrition. K. PELCZAR. *Bull. intern. l'acad. Polonoise* 1928B, 219–50. (In German.)—Pigeons fed with synthetic substitutes of oats and wheat and with devitaminized oats refused the food after 7–14 days and died in 3–4 weeks. The illness was prolonged if (1) the birds consumed the food at a slower rate, or (2) they refused the food early in the test or (3) they vomited. During the progress of the illness the amino acid content of the blood did not change, while the uric acid content increased markedly. Addn. of amino acids to the food shortened the illness, causing an early death.

J. W.

Vitamins in canned foods (KRAMER, *et al.*) 12. Agricultural research in Scotland in 1928 [mineral metabolism of animals] (ANON.) 12.

Diatetic extract. E. ALLENBY. *Brit.* 307,055, March 8, 1928. The spores of a culture of *Aspergillus oryzae* are admixed with a propagating medium rich in starch and protein substances such as mill waste or oil cake, and the mycelium or the vege-

table part of the fungus is collected and felted, the cakes formed are then subdivided, crushed, and extd. by maceration with tepid water and the ext. is evapd. to a sirupy consistency *in vacuo*. It may be used for *dietetic purposes*, or as a substitute for pancreatin in *laning*, etc.

F—PHYSIOLOGY

E. K. MARSHALL, JR.

Diffusion of oxygen and lactic acid through tissues. A. V. HILL. Univ. London. *Proc. Roy. Soc. (London)* B104, 39-96(1928).—A mathematical treatment.

JOSEPH S. HEPBURN

The hemolytic function of the spleen. II. Quantitative variations in the cholesterol content of the veins and hepatolienal systems. GEORGE FRENKEL AND V. N. NEKLUDOV. *Z. ges. expil. Med.* 61, 724-7(1928); cf. *C. A.* 23, 1170.—The blood cholesterol contents of the hepatic, jugular and portal veins were practically the same in dogs and cats. Under the same conditions, however, the blood cholesterol in the splenic veins is higher and in the renal veins lower. The reduced resistance of the erythrocytes in the venous blood of the liver is apparently not related to the cholesterol content.

F. L. DUNN

Ovarian hormone. Influence of the corpus luteum on the sexual cycle. G. CORRE AND G. PALLOT. *Compt. rend. soc. biol.* 99, 69-72(1928).—There exist in the ovary two hormones of opposing action; one, belonging to the corpus luteum, hinders ovulation.

B. C. A.

Spleen and carbohydrate metabolism. A. FRANCAVIGLIA. *Folia clin. chim. microscop.* 3, 359-69(1928); cf. *C. A.* 22, 3440.—In rabbits modifications of the blood sugar are observed from the day succeeding splenectomy, with a tendency to return gradually to normal values. Such modifications consisted in a lowering of the free sugar during fasting with 7 out of the 10 animals and in an increase in the combined sugar with 4 animals. When dextrose is subsequently introduced by intravenous injection, the free sugar never reaches the high values obtained similarly prior to splenectomy, but the combined sugar at first increases markedly and then decreases to fall into line with the free sugar. The oscillations in blood sugar normal to healthy animals become wider and more disordered after splenectomy. The modifications in the blood sugar following splenectomy thus resemble those consequent on administration of insulin, and it appears that the increased external secretion of the pancreas caused by removal of the spleen is accompanied by increase in the internal secretion.

B. C. A.

Fetus. I. Enzymes in the digestive tract. Trypsinogen in the pancreas. II. A peptone-splitting enzyme in the intestinal canal. III. Lipase in the stomach. T. TACHIBANA. *J. Kinki gynaecol. Soc.* 10, Nos. 2, 6(1927); 11, No. 1(1928); cf. *C. A.* 23, 3506, 4503.—Trypsinogen was observed in the fetal pancreas in the fourth month, a peptone-splitting enzyme (optimum p_H 7.8) in the intestinal mucous membrane in the third month, and a tributyrin-splitting enzyme in the mucous membrane of the stomach in the fourth month.

B. C. A.

β -Hormone. B. P. WIESNER AND J. S. PATEL. *Nature* 123, 449(1929).—The corpus luteum (cattle) contains an extractable substance which causes some of the effects ascribed to the hypothetical β -hormone, *e. g.*, it prevents the atrophy of the uterus in ovariectomized mature mice. It is concluded that the substance is a factor responsible for pseudo-pregnancy in diphasic animals and for the premenstrum in monophasic animals.

B. C. A.

The concentration of cholesterol and urea in normal horse serum. A. DAMBOVICRANU. *Compt. rend. soc. biol.* 101, 325-6(1929).—The av. amt. of cholesterol in normal horse serum is 0.806 g. per 1000 cc. (0.52-1.10 g.); the av. amt. of urea is 0.293 g. per 1000 cc. (0.14-0.57 g.). The concn. of both urea and cholesterol, in general, was lower in the sera of colts than in the sera of adult horses.

B. C. BRUNSTETTER

The proteins in normal horse serum. A. DAMBOVICRANU. *Compt. rend. soc. biol.* 101, 326-8(1929).—Analyses of normal sera of horses 5 months old (I), 1-2.5 yrs. old (II) and 4-15 yrs. old (III) gave the following figures (expressed in g. per 100 cc. of serum): total protein: I, 5.21-5.94; II, 6.21-7.40; III, 6.94-8.63; albumin: I, 1.60-1.95; II, 2.22-2.84; III, 1.82-3.02; globulin: I, 3.60-3.99; II, 3.38-5.22; III, 3.92-6.13; pseudoglobulin: I, 1.77-2.10; II, 1.83-3.18; III, 2.30-3.43; and euglobulin: I, 1.84-1.89; II, 1.54-2.41; III, 1.45-3.69.

B. C. BRUNSTETTER

Studies of the critical temperature of serum (55°-56°) by means of photometric measure. P. LACOMTE DU NOUY. *Compt. rend. soc. biol.* 101, 359-61(1929); cf. *C. A.*

23, 3498.—Changes in the opacity of serum to transmitted light, and the amt. of light diffracted at right angles were followed in lots of sera heated for periods up to one hour at temps. from 52° to 64°. There was no change in opacity at 52° and 55°; an increase first occurs at 57°. A decrease in the amt. of diffracted light commenced at 55°, with 40-min. heating.

B. C. BRUNSTETTER

The glucolytic power of polynuclears. PIERRE MAURIAC. *Compt. rend. soc. biol.* 101, 374-6(1929).—Polynuclears have a glucolytic action which mononuclears lack. Glucolysis is displayed *in vivo* only when indispensable physico-chem. conditions are supplied. The addn. of insulin does not favor the glucolytic action of polynuclears.

B. C. BRUNSTETTER

The alkaline reserve of the horse. D. BROcq-ROUSSEU, G. ROUSSEL AND GALLOT. *Compt. rend. soc. biol.* 101, 1020-1(1929).—Blood samples were taken from horses (without food for 24 hrs. and in repose for at least an hour). The mean alk. reserve obtained for 60 horses was 59.01% (42.96-72.08). The majority of the figures varied from 55 to 60%.

B. C. BRUNSTETTER

The pepsin of different vertebrates. I. p_H optima, and the hydrogen-ion concentration of stomach contents. H. J. VONK. *Z. vergleich. Physiol. (Abt. C, Z. wiss. Biol.)* 9, 685-702(1929).—The p_H optima for pepsin from the following sources were: Hog 1.73-1.80, frog 1.50, pike 2.20-2.47, *Acanthias vulgaris* 1.75-2.25 for the crude and 2.29-2.44 for the purified ext., *Testudo graeca* 2.2-2.5. The av. p_H range of the acidity of the stomach contents of the above vertebrates is given. This range for the pike is p_H 4.5-4.7; the pepsin content of its stomach mucosa was the highest found. The min. pepsin content was found in *Acanthias*, whose stomach contents had an av. p_H of 2.8.

B. C. BRUNSTETTER

The urinary nitrogen excretion in strenuous sport at high altitudes. MAX HOPF. *Arbeitsphysiol.* 1, 433-65(1929).—The N distribution was detd. in the urine of 61 ski runners of 12 nations in the II Olympic winter sports at St. Moritz, 1928. There was a diminution in the urea N to 58.82%, an increase in the ammonia N to 17.05%, an increase in the creatinine N to 16.8%, an appearance of creatine and an increase in the amino acids. The urine was markedly acid. The results are ascribed to the O lack in muscular effort at high altitudes.

T. M. CARPENTER

The calculation of respiration experiments. ERNST SIMONSON AND HERMANN HEBESTREIT. *Arbeitsphysiol.* 1, 570-6(1929).—Tables are given for the calcn. of gas vol. to 0° and 760-mm. pressure, and for the calcn. of the % deficit of expired air.

T. M. CARPENTER

Normal alcoholemia in physical exercise. U. CASSINIS AND L. BRACALONI. *Atti accad. Lincei* 9, 806-7(1929).—Since alc. is a possible product of the metabolism of glucose a study has been made to det. whether there is an increase in its content in muscle tissue. Eight subjects submitted to runs of 1500, 2400, 3600 meters showed negligible variation over the normal content (0.003 g. per 1000 cc. of blood), the largest difference being only 0.05%.

A. W. CONTIERI

The blood fats in low bilateral vagotomy. FILIPPO USUELLI. *Boll. soc. ital. biol. sper.* 3, 1275-8(1928).—After having noted after several operations of vagotomy that the blood serum was invariably milky, the operation was performed on various dogs, and the fats in the blood were detd. after Kumagawa-Suto, the blood being withdrawn 16-18 hrs. after meals. The ratio saponifiables : unsaponifiables was also detd. with the following results. Bilateral vagotomy always causes an increase in blood fats varying from 100% after 3 or 4 days to a max. after 10-15 days of 300%, while even after 110 days, it was almost 200% in one dog. The increase occurs in the saponifiable as well as the unsaponifiable, but not so rapidly, the ratio sapon. : unsapon. decreasing from 2 to about 1. Hyperglucemia and glucosuria are invariable attending conditions, although these are transitory conditions. The residue on drying of the blood also shows a slight increase, this being undoubtedly an expression of the lipemia. Unilateral vagotomy, however, does not cause appreciable glucemia or lipemia, nor affect the ratio sapon. : non-sapon. appreciably. U. advances the hypothesis that vagus contains regulator fibers, in the suprarenals, which control fat production and the neoformation of cholesterol.

A. W. CONTIERI

Histological observations on the behavior of fats and lipoids on animals after vagotomy. FILIPPO USUELLI AND GIUSEPPE GOTTARDI. *Boll. soc. ital. biol. sper.* 3, 1291-4(1928).—In a previous paper (cf preceding abstract) the behavior of the fats in blood of dogs submitted to bilateral vagotomy was noted. In this work all the organs in the abdominal cavity were studied histologically. Liver.—The hepatic cells show droplets and fat colored by Sudan III, the droplets being due to cholesterol esters. The bile ducts were full of drops of fatty acids; staining with Nile-blue sulfate indicates

cholesterol esters here, also. *Kidneys*.—With Nile-blue sulfate, fatty acid was shown to be present; lipoids were also shown present by Ciaccio's method. *Suprarenals*.—Sudan III and hema toxylin show the presence of much more than the normal amt. of fatty acids. *Intestines, lymphatics, gall bladder*.—All showed excessive fatty acids with Sudan III. *Pancreas*.—The interstitial stream was very rich in fatty acids; in the islands, however, there was no trace of fats or lipoids. *Lung* showed considerable lymph tissue, but no lipoids. The excessive amts. of lipoids, particularly in the intestines, which is not due to fat absorption, as tests were taken 16–18 hrs. after meals, indicate increased excretion of cholesterol by means of bile, and thus an attempt of the organism to combat hypercholesterolemia. A. W. CONTIERI

The absorption of fats. OSCAR CANTONI. *Boll. soc. ital. biol. sper.* 3, 1278–82 (1928).—In a series of 9 expts. on dogs, the fatty acid content of the portal as well as carotid blood was detd. by the method of Bloor (*C. A.* 16, 2341) at various intervals after a diet of fatty substances. Some typical results follow: 3 hrs. after meal, % fatty acid portal blood was 0.592, carotid 0.414; % cholesterol, portal 0.109, carotid 0.131; after 24 hrs., portal 0.642, carotid 0.638; cholesterol, portal 0.074, carotid 0.079. In all cases the fat content of the arterial blood was higher, so that the portal vein plays an important part in the absorption of fats; no definite conclusion could be drawn in regard to the cholesterol. A. W. CONTIERI

The respiration of eggs and production of ammonia during hatching. RIVKA ASHBEL. *Boll. soc. ital. biol. sper.* 3, 1310–3 (1928).—Eggs hatching have been found to evolve NH_3 during respiration, the amount increasing as the elapsed time since fertilization increases, i. e., 222×10^{-6} g. NH_3 in 1 hr., 6 hrs. after fertilization, 287×10^{-6} g. 26 hrs. after, and 377×10^{-6} g., 50 hrs. after. Eggs from silk-worms were used in these expts. A. W. CONTIERI

Studies in milk secretion based on the variations and yields of milk and butter fat produced at morning and evening milkings. S. BARTLETT. *J. Agr. Sci.* 19, 36–47 (1929).—Material is presented which shows month by month the lactation yields of cows in respect to milk and fat. Smaller proportions of milk and fat at the morning milkings are yielded in early lactation by all cows, but this point is most pronounced in heifers and also in heavy yielding cows with relatively small udders. It is suggested that with such animals reabsorption of milk occurs during a long night interval. Studies of seasonal variations in yield of milk and fat show that the morning milking does not respond as much as the evening milking to the stimulus to secretion which functions during May and June. A discussion of the quality of milk at different seasons is presented. P. R. DAWSON

The cardiac hormone. The action of active substances. R. RIGLER AND F. TIRMANN. *Arch. ges. Physiol.* (Pflüger's) 222, 450–9 (1929); cf. *C. A.* 22, 2597.—The existence of a cardiac hormone, regulating the automaticity of the heart, could not be substantiated. ARTHUR GROLLMAN

Ultramicroscopic studies of the sciatic nerve of the frog (in the normal, narcotized and under the influence of electrolytes) in their relation to the appearances of fixed preparations. LEOPOLD AUERBACH. *Arch. ges. Physiol.* (Pflüger's) 222, 493–509 (1929). ARTHUR GROLLMAN

The isolation of 3,5-diiodotyrosine from the thyroid. G. L. FOSTER. *J. Biol. Chem.* 83, 345–6 (1929).—From a sample of 100 g. thyroglobulin, 33% of the total I was isolated as diiodotyrosine and 16% as thyroxine. ARTHUR GROLLMAN

The hydrogen-ion concentration of perspiration. ALFRED MARCHIONINI. *Klin. Wochschr.* 8, 924–6 (1929).—The combined perspiration collected from a person in a hot bath chamber is invariably acid (p_H 4.5 to 6.5). This may be divided into the secretion from 2 kinds of glands, namely the apocrine perspiration (from the glands in the axilla and in the genitoperineal region) which is nearly neutral and may even be alkaline and the eccrine perspiration which may have a p_H of 4.0 to 5.5. Perspiration induced by pilocarpine is less acid. The total perspiration may be alk. and it rarely has a p_H lower than 6.0. The apocrine perspiration is always alk. MILTON HANKE

The diagnosis of pregnancy by examining the urine according to the method of Zondek and Aschheim. FERDINAND WERMETER AND EBERHARD SCHULZE. *Klin. Wochschr.* 8, 970 (1929).—A complete confirmation of the results of Zondek and Aschheim (cf. *C. A.* 22, 4600). MILTON HANKE

Changes in the production of the uterus-stimulating, hypophyseal substance after castration and after x-ray irradiation of the ovaries in guinea pigs. SIEGERT. *Klin. Wochschr.* 8, 979–81 (1929).—The secretion of the posterior lobe of the hypophysis, in so far as it acts upon the uterus, is controlled by the vegetative centers of the mid-brain which, in turn, is stimulated by the ovarian hormone. A decrease in the output of

ovarian hormone leads to a decreased secretion of the posterior lobe of the hypophysis. Röntgen castration is not identical, in its action, with mech. castration. The x-rays produce first a transitory stimulation of the ovaries which leads to a hypersecretion of hormone by the hypophysis. The atrophy of the ovaries, which is the next stage, is seldom complete.

MILTON HANKE

Parathyroid hormone and calcium metabolism. MARTIN NOTHMANN. *Klin. Wochschr.* 8, 1068-9(1929).—Parathyroid exts., prepd. according to the directions of Collip, are yellow and are frequently slightly turbid. Such exts. have shown marked differences in their action when injected into different species of animals. The expts. described were carried out with a German prepn. called Paratotal which is clear and colorless. This prepn. elicits an identical reaction when injected into man, dogs, cats or rabbits. The Ca concn. in the blood is elevated to or above normal. The max. concn. is attained in 0.5 to 1 hr. The blood Ca has dropped to its initial value after 3 hrs.

MILTON HANKE

The ionic composition of the stomach contents. E. SCHAIRES. *Klin. Wochschr.* 8, 1113-5(1929).—The acidity, total chloride, Na and K content of the gastric juice were detd. after feeding an alc. test meal. The K concn. is about 11% of that of the Cl concn. An increased secretion of acid is associated with a decreased Na content. The Na is markedly increased in cases of hypo or anacidity.

MILTON HANKE

Lactic acid formation in muscle extracts. IV. A comparison between glucose and glycogen in respect of lactic acid formation and phosphoric ester accumulation. DAVID STIVEN. *Biochem. J.* 23, 583-6(1929).—The extent of ester accumulation is small compared with that from glycogen. Both the rate and extent of the lactic acid from glucose are greater than from glycogen.

BENJAMIN HARROW

Investigations on the fats of Japanese birds. II. RYOSHI KOYAMA. *J. Soc. Chem. Ind. (Japan)* 31, 570-3(1928); Suppl. Binding 31, 140-1B; cf. C. A. 23, 3116.—The characteristics of the fats from (1) *Nannocnus curythmus* (Swinhoe), (2) *Sturnia violacea* (Boddaert) and (3) *Nycticorax nycticorax nycticorax* (Linn) are given. They all contain higher unsatd. acids. The I values of the fats of female birds were generally higher than those of male birds.

S. OKA

The function of the heart and central nervous system in mammals during marked oxygen deficiency. L. ASHER, H. KAWAI AND N. SCHEINFINKEL. *Z. Biol.* 89, 139-48 (1929).

FRANCES KRASNOW

The oxidation of lactic acid in muscle. AMANDUS HAHN AND E. FISCHBACH. *Z. Biol.* 89, 149-58(1929).—Despite marked respiration there was no oxidation of lactic acid in washed muscle to which boiled ext. was added. If according to Myerhof and Szent-Györgyi, washing with water removes a coenzyme from muscle, then the addn. of the coenzyme to boiled ext. should cause a decrease in the lactic acid. This was not the case. Washing with water also removes the enzyme itself. However, washing with phosphate buffer soln. did not inhibit the decoloration of methylene blue by lactic acid in vacuum. Conclusion: Lactic acid dehydrase is removed from muscle by water. There is no need for the assumption of a coenzyme.

FRANCES KRASNOW

Chemical stimulus essential for growth by increase in cell number. F. S. HAMMETT. *Proc. Am. Phil. Soc.* 68, 151-61(1929); cf. C. A. 22, 4153.—Cell proliferation of root hairs and of chick embryos is stimulated by the sulfhydryl group such as occurs in thioglycollates and cysteine.

W. D. LANGLEY

Solubility of uric acid in the blood. OWEN S. GIBBS. *Science* 70, 241-2(1929).—Uric acid which seps. from fresh urine of the fowl may usually be redissolved upon warming of the urine, whereas that which seps. upon long standing cannot be redissolved by this treatment. The sol. form may be pptd. by addn. of Me_2CO . Blood of fowls of which the ureters were tied also yielded a sol. form of uric acid upon addn. of Me_2CO . It seems, therefore, that uric acid in fowl's blood is a sol. form different from ordinary uric acid.

W. D. LANGLEY

Titanium in animals. GABRIEL BERTRAND AND MME. VORONCA-SPIET. *Compt. rend.* 189, 221-3(1929).—Ti is present in animal tissues in proportions that differ with the organs and with the species. In the horse, calf, sheep and hog, the liver contained 0.5-0.6 mg. per kg., the heart, lungs and kidneys about half this proportion, while the muscles, brain, spinal cord and blood contained too little to give a pos. test. In the rabbit, the liver did not give a test, but the hair contained 2.2 mg. per kg. Fish contained 0.3 to 0.9 mg. Ti per kg., and crustaceans and mollusks were even richer in Ti.

AMY LE VESCONTE

Blood sugar and fermentable blood sugar as determined by different methods. OTTO FOLIN AND HAGVIN MALMROS. *J. Biol. Chem.* 83, 121-7(1929); cf. C. A. 21,

122; 23, 4402.—By using the new weakly alk. G₂ method of Folin and following the procedure of Folin and Svedberg, "clear cut evidence of the presence of some unknown fermentable and reducing material" in 14 out of 28 samples of blood has been obtained. Cf. following abstr.

The nature of blood sugar. II. MICHAEL SOMOGYI. *J. Biol. Chem.*, 83, 157-64 (1929); cf. *C. A.* 23, 872.—All the common methods for detg. blood sugar give identical results within the rather narrow limits of exptl. errors provided S.'s Zn pptn. technique is used which removes the non-fermentable reducing substances present in blood. Evidence is presented indicating that the substance escaping oxidation in Folin's method when the H₂WO₄ filtrate is used is not a fermentable sugar but the complex of reducing non-sugar substances. The previous findings of Somogyi and Kramer that "the assumption that blood contains any fermentable sugar other than glucose is unwarranted," is thus confirmed. The paper is a reply to Folin's criticism (*C. A.* 23, 1806) of this finding.

The basal metabolism of the inhabitants of the tropics. P. J. TEDING VAN BERKHOUT. *Mededeel. Dienst Voldgezondheid Nederland-Indië* 18, 1-69.—The basal metabolism of 12 Europeans, 3 Indo-Europeans and 12 Malays has been measured by the Krogh closed system and the Douglas open system. The results agreed with measurements made on Europeans in the tropics for the past 8 or 9 years and indicated a lowering of the basal metabolism in the torrid regions. The thermogenesis for Europeans was found to be 35.5 ± 0.48 cal. M₂ per hour while that calcd. by the DuBois method was 39.0 ± 0.2 cal. M₂ hour. A similar discrepancy was evident with the Malays who showed also a lower metabolism in the torrid regions. This discrepancy needs investigation.

A study of the thermogenesis of the tropical inhabitants during a march on a horizontal surface. P. J. TEDING VAN BERKHOUT. *Mededeel. Dienst Voldgezondheid Nederland, Indië* 18, 71-80 (1929).—The thermogenesis was detd. on 3 Europeans and Malays during a 5-min. march on a horizontal surface at a rate of 60 to 90 m. per min. The heat production of the Europeans was 12% less than with the others. With Europeans as well as with Malays the heat production was almost doubled by increasing the speed from 60 to 90 m. per min. Further work is being done along these lines.

The basal metabolism of tropical inhabitants. C. EIJKMAN. *Mededeel. Dienst Voldgezondheid Nederland-Indië* 18, 81-4 (1929).—A criticism of the articles published by P. J. Teding van Berkhou (preceding abstrs.).

Investigation of the regulation of temperature. I. The effect of surrounding temperatures. M. MARSCHAK AND L. KLAUS. *Arch. Hyg.* 101, 297-307 (1929).—The amt. of NaCl and H₂O lost from the blood by the sweating produced by exposure to high temps. is increased if H₂O is taken during the period of exposure. The loss is not as great if a 1% soln. of NaCl is taken. II. The effect of high surrounding temperatures upon the physical state of the blood and upon the regulation of the temperature in man in connection with water and salt intake. M. MARSCHAK AND C. DUKELSKY. *Ibid.* 325-37.—Exposure to high temps. produces first a diln. of the blood and later, a concn. The concn. is decreased only when NaCl is taken in addn. to a diln. of H₂O.

Further contributions on the biochemistry of iodine. The influence of iodine on estrus in cattle. ISTVAN WEISER AND A. ZAITSCHEK. *Fortschr. Landw. Wiss.* 4, 275-7 (1929).—In some cases the addn. of I to the diet brought about estrus in animals in which it had been very infrequent or absent.

Studies on the regulatory capacity of tissues. M. COMEL. *Arch. ital. biol.* 80, 193-205; *Boll. soc. ital. biol. sper.* 3, 1297-1300 (1928).—Exptl. evidence is offered to show the remarkable capacity of muscle tissue to regulate the reaction whereby this is maintained practically at the neutral point.

The effect of hydrogen-ion concentration on the solanine hemolysis. R. ROBERT FRAGM. *Biochem. Z.* 209, 319-25 (1929).—Solanine hemolysis is strongly affected by changes in H-ion concn. and whereas at pH 5.5 there is only a barely observable hemolytic action the solanine becomes effective even in a diln. of 1:266000 at pH 10. The latter effect manifests itself in 2 stages: first a rapid action due to the settling of solanine as the reaction changes from the acid to the alk. side; secondly, a slowly acting action due to the OH ions. The detoxicating effect of CO₂ is not at all specific for solanine, but is merely due to the acidity.

The bile acid content of the blood under different physiological conditions. CHARLET. *Biochem. Z.* 210, 42-69 (1929).—The method of Aldrich and Bledsoe was

egg. HANS VON EULER AND HARRY HELLSTRÖM. *Biochem. Z.* 211, 252-8(1929).—The larger part of the carotinoids present in the hen's egg shows very little loss during the period of incubation. S. MOROGLIS

Influence of the hydrogen-ion concentration and the importance of the phosphate ion in the gaseous exchange of tissues. M. COMEL. *Arch. ital. biol.* 80, 180-7; *Boll. soc. ital. biol. sper.* 3, 1294-6(1928).—The gaseous exchange of tissues is a function of the pH and especially of the concn. of the protein anion. The phosphate ion increases the respiratory exchange of hashed muscle at different pH values. S. MOROGLIS

The thyroid gland problem. WALTER M. BOOTHBY. *Endokrinologie* 3, 1-28 (1929).—General lecture. S. MOROGLIS

Urea formation in the organism. II. The urea production in the muscles. GRÜSSEPE SUNZERI. *Ann. clin. med. sper.* 16, No. 4, 18 pp.; *Chem. Zentr.* 1928, II, 1794; cf. C. A. 21, 3942.—The dog muscle artificially perfused with blood is able to form urea. This becomes especially noticeable, if the animal is sacrificed during the early part of digestion. Introduction of HCl into the stomach does not favor the urea formation. III. Influence of fasting on the urea formation in the muscles during artificial perfusion. *Ibid* 16, No. 4, 8 pp.; *Chem. Zentr.* 1928, II, 1794.—No formation of urea occurs during the artificial perfusion of the fasting muscle. IV. Does muscular contraction favor the urea formation? *Ibid* 16, No. 4, 9 pp.; *Chem. Zentr.* 1928, II, 1794.—The urea formation of the muscle remains unaltered during muscular contraction. V. Behavior of urea in blood and muscles during antiseptic autolysis. *Ibid* 17, No. 1, 7 pp.; *Chem. Zentr.* 1928, II, 1794.—On autolysis of short duration a limited urea formation may be observed in the muscles as well as in the blood, though this formation is not so pronounced as with artificial perfusion. A const. formation occurs after 80 hrs. of autolysis of muscles of an animal killed during digestion. The urea formation was greater in the autolysis expts. of longer duration than in the perfusion expts., because in the latter the urea formation depends on the specific metabolism of the surviving muscle fiber, which selects from the circulating blood the substances suited for urea formation. VI. Behavior of the urea content of some organs during autolysis. *Ibid* 17, No. 1, 11 pp.; *Chem. Zentr.* 1928, II, 1794.—Spleen and intestinal mucosa, when autolyzed with F salts, generally show differences in their urea content, but these differences also depend on the bodily condition of the animal, i. e., whether it was killed during the hunger or during the digestion period. Only the intestinal mucosa of the dog during digestion showed a const. increase of urea. G. SCHWOCH

The pentose nucleic acids in the animal organism with special regard to the nucleic acids of the pancreas. ERIK JORPES. *Veröffentl. chem. Abt. Karolinschen Inst. Stockholm* 1928, 253-573; *Chem. Zentr.* 1928, II, 1343.—The nucleic acid content of the pancreas and some other organs was investigated. The various organs have an approx. equally high content of free phosphates (about 0.0437% phosphate-P in the fresh gland). The lecithin content is specific and almost const. for each organ. The av. content of lipid-P is 0.1267% in the fresh pancreas. The probable nucleic acid content (which was detd. indirectly) was considerably higher in the pancreas than in any other organ, with the exception of the thymus, which is known to have undergone involution in the adult organism. The probable content of nucleic acid-P in the fresh beef pancreas is 0.223%, while in the liver it is about 0.104, in the spleen 0.145, in the parotid 0.107 and in the mucous membrane of the fundus ventriculi 0.088%. The relative nucleic acid content of the pancreas is therefore about twice as great as that of the other inner organs with the exception of the thymus. The mucous membrane of the stomach is not richer in nucleic acid despite its strong secretory activity. The parotid, which histologically resembles the pancreas very much, contains only 0.5 as much nucleic acid and only 0.2-0.25 as much pentose as does the pancreas. This justifies the assumption that the nucleic acids serve as stationary sources of alkali in the secretion of the pancreas. A remarkable conformity was discovered in detg. the nucleic acid-P of pancreas and thymus split off by mineral acids. In the purine nucleotides P is quant. split off by heating on the water-bath with 5% H_2SO_4 for 2.5 hrs., while with pyrimidine nucleotides only a few % were removed. On acid hydrolysis, 50.1% of the nucleic acid-P of the thymus is split off, as may be expected from the tetranucleotide character of the thymonucleic acid. With a content of 0.441% nucleic acid-P in the thymus, the pentose nucleic acids calcd. as pentose tetranucleotide, represent 14.2% of the entire nucleic acid-P. In the pancreas with a pentose content of 0.445% and a nucleic acid-P content of 0.223% the pentose nucleic acid forms the prevalent part. About 50% of the nucleic acid-P of the pancreas is split off by means of acid hydrolysis. The fact that the nucleic acids in the pancreas on acid hydrolysis behave exactly like the nucleic acids of the thymus favors the view that the pentose

nucleic acids present in animal organs have tetranucleotide character. There are no differences in compn. between the glands of herbivores and carnivores. As to the analysis of the nucleic acids of the pancreas, J. first gives a survey of the history of the nucleic acids. A pentapentose nucleotide with 3 purine nucleotides exists in the pancreas. It contains the main amt. of the nucleic acid present, since the thymonucleic acid amts. to not more than 0.33 of the total nucleic acid content. The outstanding position, which guanylic acid is supposed to occupy, is not well founded. The guanylic acid is only present as a mononucleotide in the nucleic acid complex. The guanylnucleic acid of Feulgen does not exist. The pentose nucleic acid of the pancreas resembles the yeast nucleic acid. The original paper has to be consulted for the extensive analytical and methodical material.

G. SCHWOCH

The formation of adrenaline-like substances in the heart following the excitation of the sympathetic nerve. A. B. LANZ. *Arch. néerland. physiol.* 13, 423-36(1928).—A substance which resembled adrenaline was formed in the heart of *Rana esculenta* and *Rana temporaria* on stimulation of the sympathetic nerves. The material was given up to Ringer's soln. with sympathetic stimulation and accelerated another heart. Perfused through the frog's hind limbs in very weak concn. it produced vaso-dilatation, in higher concn. vaso-constriction. The unknown substance also inhibited the rhythmic contractions of the isolated frog's stomach. Since the material was destroyed by boiling and gave Russmann's adrenaline reaction with sulfanilic acid and HgCl it was adrenaline.

M. H. SOULES

G—PATHOLOGY

H. GIDEON WELLS

The clinical use of viatmin A as an agent against infection. PH. PAGNIEZ. *Presse méd.* 37, 1123-4(1929).

A. E. MEYER

Physicochemical conditions of the thermostability of diphtheria antitoxin. V; KULIKOV, P. SMIRNOV, AND M. BOBKOVA. *Compt. rend. soc. biol.* 98, 1503-4(1928). cf. C. A. 22, 808, 2001.—On addn. of alkali to the antitoxin gradual pptn. takes place in the p_H range 4.8-7.0; at maximal pptn. (p_H 6.1-6.5) all the antitoxin is present in the ppt. Heating and treatment with acid also lead to concn. of the antitoxin or removal of attendant substances.

B. C. A.

Absorption of tuberculin. A. BOQUET, L. NÈGRE AND J. VALTIS. *Compt. rend. soc. biol.* 99, 9-12(1928).—If tuberculin is treated with a sufficient quantity of finely divided C, it is freed from all active (antigenic and toxic) substances. The adsorption complex so formed is irreversible and indissociable *in vivo*.

B. C. A.

Probable significance of the intestinal fermentation in certain morbid conditions. G. GHERARDINI. *Folia clin. chim. microscop.* 3, 289-344(1928).—Investigation of the volatile fatty acids contained in the feces of dogs from which the pancreas had been excised showed the presence of these acids in abnormally large amts., but it was not found possible to det. the intensity of the fermentation producing such excess of acid. An attempt is made to trace a relationship of fermentative processes, considered as the cause of acidification of the intestinal medium, to the absorption and to the chem. compn. of the fats eliminated. The fundamental question of the principal seat of the fermentations in question remains unsolved.

B. C. A.

Behavior of the combined sugar during alimentary hyperglucemia. C. TOSCANO. *Folia clin. chim. microscop.* 3, 344-58(1928).—In dogs alimentary hyperglucemia is almost always accompanied by diminution of the combined sugar, which may disappear entirely from the blood. Such diminution sometimes corresponds with the greatest intensity of the hyperglucemia, but often the min. values of the combined sugar occur when the free sugar has been lowered to about its normal value. The diminution or disappearance of the combined sugar in the blood persists even after injection of insulin. If, during insulin hypoglucemia, dextrose is rapidly introduced into the circulation, diminution and disappearance of the combined sugar are observed even when the increase in free sugar does not exceed the normal values. Thus, the diminution of combined sugar is not a consequence of the hyperglucemia, so that it cannot be assumed that diminution of the combined sugar resulting from rapid introduction of dextrose represents a defensive mechanism of the organism against hyperglucemia.

B. C. A.

Cause of death of animals with pancreatic fistula. S. I. PRIKLADOVITZ. *Russ. J. Physiol.* 12, 3-28(1929).—The alkali reserve of healthy, adult dogs of different races varies between 40 and 60 cc. of CO₂ under lab. conditions; the variation was less marked in dogs of the same race. The blood sugar varies between 50 and 110 mg. per 100 cc. of blood. There is a marked drop in the alkali reserve of dogs with pancreatic fistula.

resulting in the death of the dog with a marked acidosis. There is no change from the normal in the blood sugar level. B. C. A.

The destruction of the bactericidal power of blood. Application to blood culture. L. BOREZ AND L. A. ROBIN. *Compt. rend. soc. biol.* 101, 1009-12(1929); cf. *C. A.* 23, 4739.—The bactericidal power of blood adjusted to p_H 5-6 is destroyed in less than 15 min. Subsequent adjustment to a more alk. reaction, e. g., p_H 7.5, permits rapid growth of the microorganisms present. A sample of the patient's blood (8 cc.) is added to 2 cc. of a sterile acid citrate soln. (3.75 g. Na citrate, 5.60 g. $KHSO_4$, add distd. H_2O to 100 cc.). The reaction of the citrated blood varies from p_H 5.3 to 5.5. Its acidity is then corrected by adding it to 100 cc. agar, alk. to phenolphthalein and contg. 2% glucose. Blood cultures in 4 cases of typhoid fever and 13 cases of septicemias gave 17 positive results using acid citrate but only 6 positive results using neutral citrate or bouillon. A higher count with earlier appearance of the colonies was also obtained using acid citrate. B. C. BRUNSTETTER

Accelerating action of phenol on adeno-carcinoma in mice. G. DE ANGELIS. *Boll. soc. ital. biol. sper.* 3, 1340-7(1928).—Cancerous cells from mice immersed in 0.5% C_6H_5OH soln. are more prolific in their propagation both *in vivo* as well as *in vitro*, if inoculated within $1/2$ to 2 hrs. after removal and treatment with C_6H_5OH . Beyond this time the action becomes slower and after 24 hrs. the whole becomes free from any cancerous cells. C_6H_5OH is a by-product of tar, and also may be formed in animal metabolism, tar being known to produce cancer under certain conditions. This compd. (C_6H_5OH) may, therefore, be a factor in stimulating cellular activity which results in cancer.

A. W. CONTIERI
The albumin-globulin relations in the serum, blood sedimentation rate and Von Pirquet skin reaction in pulmonary tuberculosis. F. SCHEURLEN. *Beitr. Klin. Tuberk.* 69, 59-69(1928).—The refractometric and viscometric detn. of the albumin-globulin relation in the serum revealed an intimate relation with the grade of activity of the disease, its extent and tendency toward liquefaction. The blood sedimentation reaction closely paralleled the albumin-globulin picture. An increase in the Pirquet skin reaction in most active non-progressive cases is viewed as a reinforcement of resistance. On the av. 4 months sanatorium treatment revealed no change in the albumin-globulin relation or the sedimentation rate. H. J. CORPER

The role of the lung in the intermediate nitrogen metabolism. The content in total and residual nitrogen in the venous blood of tuberculous patients prior to and after pneumothorax. A. M. CHARNY AND S. KRASOVITZKII. *Beitr. Klin. Tuberk.* 69, 373-84 (1928); cf. *C. A.* 23, 980.—The total and residual N in the blood of 11 tuberculous patients prior to and after pneumothorax treatment was detd. An exclusion of part of the pulmonary tissues resulted in a residual N increase (up to 30-70% over normal) in the venous blood. Following institution of pneumothorax the residual N increase was proportionate to the compression of the healthy parts of the lung, increasing from 100 to 200% or more. Conclusion: Pneumothorax and exclusion of a large part of the lung cause an increase of the residual N products in the venous blood with a non-manifest clinical azotemia. Thus there is a N retention independent of the respiratory function. H. J. CORPER

The influence of pulmonary tuberculosis upon the respiratory regulation. FRITZ POMPLUN. *Beitr. Klin. Tuberk.* 69, 529-30(1928).—In pulmonary tuberculosis the anoxic condition can be explained as a disturbance of the pulmonary passage for O. The excretion of CO_2 is also effected with the resultant shift of the p_H to the acid side. In moderate and severe cases of pulmonary tuberculosis there is a coincident and increasing O deficiency and CO_2 increase which affects the respiratory centers. H. J. CORPER

Basal metabolism in tuberculosis with special consideration of the specific dynamic protein action. FRITZ SALUS AND HUGO ADLER. *Beitr. Klin. Tuberk.* 70, 733-58 (1928).—In 61 cases of predominantly fibrous type the authors could find no relation between the basal metabolism and the activity of the pulmonary process, and pulmonary collapse was without effect. It is, however, believed that the tuberculous infection is the main cause of an increased metabolism even though this is of no value in diagnosis or therapeutics. In testing the sp. dynamic egg white action the authors found subnormal, normal and increased values, the latter most frequent up to 70%. The relation between the basal metabolism and sp. dynamic protein effect was not detd. Activity and the height of a sp. protein effect did not parallel each other. It is believed that in certain cases a limitation of the protein diet is important in pulmonary conditions. H. J. C.

Oxygen and carbon dioxide analyses of the arterial and venous blood in pulmonary tuberculosis. FRITZ POMPLUN. *Z. Tuberk.* 51, 185-99(1928).—In moderate and

severe cases of pulmonary tuberculosis there is a diminution of the O_2 of the blood and an increase in the CO_2 as compared to normal. Analyses are only to be viewed from the standpoint of the season of the year and these exams. were made in the winter when the av. O was lower and CO_2 higher than during spring and summer. The variation in the gas analyses is related to the form of the disease and the relative O_2 deficiency parallels the severity of the process. Increase in the CO_2 is not alone dependent upon the extent of the pulmonary tuberculosis. The destruction of pulmonary tissue occasions a diminution in the amt. of newly formed oxyhemoglobin but makes the liberation of CO_2 more difficult. A disturbance of the gas metabolism in the lung eventually acts as a block for the CO_2 excretion and there results an increase in the CO_2 of the arterial blood. In severe pulmonary tuberculosis there appears a paradoxical relation between the alkali reserve and the amt. of CO_2 . H. J. CORPER

The action of the Röntgen rays upon the activity of Koch's old tuberculin in skin tests. TH. ABRAMOWITSCH AND I. RABUCHIN. *Z. Tuberk.* 51, 462-7(1928).—In suitable diln. (1:1000) and with proper Röntgen ray dosage (100 and 50% erythema dose) tuberculin is decidedly weakened when administered intracutaneously, while occasionally its action is increased (100% raying and 1:10,000 soln.). Controls of glycerol bouillon and salt soln. are not affected by the Röntgen ray. H. J. CORPER

The precursor of urinary pigment in serum. H. K. BARRENSCHEEN AND LUDWIG POPPER. *Wiener klin. Wochschr.* 42, 704-5(1929).—From serum of a few cases of nephritis which had a characteristic yellow color without increase in bilirubin there was isolated the copper salt of a N- and S- contg. substance identical in characteristic properties with urochrome. Detn. of reducing power towards $FeCl_3$ gives a convenient method for its detn. in the trichloroacetic acid filtrate of serum. D. B. DILL

Anaphylactic experiments with extracts of liver fluke (*Fasciola hepatica*). C. H. KELLAWAY. *Australian J. Exptl. Biol. and Med. Sci.* 5, 273-83(1928); *Australian Sci. Abstracts* 8, 5.—There appear to be two antigenic substances in exts. of liver fluke, one heat stable present in saline exts., but not sol. in alc. This is a true anaphylactic antigen. The other is probably a lipide, sol. in alc., capable of sensitizing guinea pigs, but not of discharging the sensitiveness of sensitive plain muscle. This may be identical with the antigen responsible for complement fixation. H. L. D.

Analysis of an unusually large prepuce stone. GG. SOIKA. *Arch. Pharm.* 267, 465-7(1929).—The total wt. of this pathol. formation was 10.47 g., being 3.25 cm. long and 2.60 cm. thick. It consisted of uric acid and urates, resp., the other constituents detected being H_2O , cholesterol, Ca, Mg, NH_4 , K, Na, Cl, NO_3 and PO_4 in greater or less amts. W. J. E.

The role of lipoids in the pathology of tuberculosis. G. PLATONOV. *Rev. tubercul.* 9, 561(1928); *Rev. hyg. méd. prév.* 51, 533.—Fatty acids do not serve as nutrient media for the tubercle bacillus; non-satd. fatty acids inhibit growth when present in 0.1% concns., many of the cells being killed. Lecithin and cholesterol have a bactericidal action on the tubercle bacillus. There was no direct assimilation of lipoids. The organisms produce a little glycerol from lipoids by the action of lipase. A chem. study of the compn. of diseased and normal tuberculous organs was made. C. R. F.

Studies on the physiology of the parathyroid glands. I. Calcium and phosphorus studies on a case of idiopathic hypoparathyroidism. FULLER ALBRIGHT AND READ ELLSWORTH. *J. Clin. Investigation* 7, 183-201(1929). ARTHUR GROLLMAN

The glycogen content of the liver at autopsy. HANS POPPER AND OSKAR WOZASEK. *Wiener med. Wochschr.* 79, 456-8(1929).—The glycogen content of the liver was detd. after death from a variety of diseases. ARTHUR GROLLMAN

The relation between fatigue and death. GUSTAV EMBDEN. *Klin. Wochschr.* 8, 913-7(1929).—A review in which the chem. changes produced by fatigue are compared with those observed after death. MILTON HANKE

Biochemical investigations on skin diseases. G. STÜMPKE AND GG. SOIKÁ. *Klin. Wochschr.* 8, 917-23(1929).—Basal metabolism studies may prove to be of value as a diagnostic measure in certain types of skin diseases. Certain cases of eczema and psoriasis may, perhaps, be differentiated in this way. Low values for sp. dynamic action (+ 4.7 to + 9.5) were obtained in some cases of eczema. The interferometric methods cannot be recommended for detg. the presence of hydrolytic enzymes in the blood. MILTON HANKE

Blood sugar in cardiac diseases. M. CHASANOV. *Klin. Wochschr.* 8, 934-6(1929).—The blood sugar is frequently low in cases in which the heart valves are not functioning properly. The glucemia curve obtained after administering glucose to such patients is characterized by a long rise and a long fall. The peak may be higher than

normal. The blood sugar is normal in cases of cardiosclerosis with insufficiency.

MILTON HANKE

The unitarian action of immune bodies (dehydration). L. REINER. *Klin. Wochschr.* 8, 936(1929).—An immune body is primarily a dehydrating agent. A number of immune reactions can be produced artificially by using a dil. soln. of tannic acid; e. g., blood corpuscles are agglutinated when they are treated with tannic acid (0.2 to .02%). The phenomenon is indistinguishable from that which occurs when the corpuscles are treated with an agglutinating serum. The tannic acid agglutinated corpuscles are hemolyzed when they are mixed with fresh guinea-pig or frog serum; they are rapidly phagocytosed when they are mixed with an emulsion of leucocytes. A tannin dehydrated antigen can also fix complement without the action of the sp. serum.

MILTON HANKE

The time of beginning alimentary hyperglucemia after the intraduodenal administration of glucose. Form of the resorption and assimilation glucemia curves. (Arterial blood examination.) O. KLEIN AND J. HEINEMANN. *Klin. Wochschr.* 8, 977-9(1929).—The first signs of a hyperglucemia occur 5 to 6 min. after the intraduodenal administration of glucose to normal individuals. The blood-sugar curve is smooth. A hyperglucemia is demonstrable in 1 min. in diabetics that are similarly treated. The blood-sugar curve shows numerous irregularities.

MILTON HANKE

Is the so-called pernicious anemia of rats (*Bartonella anemia*) related to morbus Biermer? HARRY NEUMANN. *Klin. Wochschr.* 8, 1017-21(1929).—Rats, with a latent *Bartonella* infection, that have been fed Fe preps., show a transitory rise in hemoglobin 2 days after splenectomy, but the further course of the disease proceeds in the usual manner. Administration of liver does not have a beneficial action upon the course of the disease. The effect is detrimental, if anything. The *Bartonella anemia* is quite dissimilar from pernicious anemia and this rat disease should not be referred to as pernicious anemia.

MILTON HANKE

Stomach function in heart and kidney disease. J. FLIEDERBAUM AND N. PIANKO. *Klin. Wochschr.* 8, 1076-9(1929).—The stomach functions normally in cases of heart and kidney disease that are not complicated with edema or uremia. Kidney insufficiency with an elevated blood urea is often associated with an increased excretion of urea in the gastric juice. Cases with cardiac and renal edema show a lowered gastric secretion and a decreased concn. of acid and chloride in the gastric juice. The rate of excretion of neutral red, administered intramuscularly, is decreased. A local edema has no effect upon gastric secretion. The gastric disturbances do not parallel the severity of the heart or kidney lesion. They depend rather upon the edematous tendency of the skin as measured by the absorption time (method of McClure and Aldrich), dryness in the mouth and the oliguria.

MILTON HANKE

Significance of the lymphocytogenic tissue (thymus, spleen, lymph glands) for the pathogenesis of spasmophilia in infants. A. NITSCHKE. *Klin. Wochschr.* 8, 1123-5(1929).—A substance can invariably (10 cases) be isolated from the urine of spasmophilic infants which, when injected into rabbits, produces a spasmophilic syndrome (reduction of serum Ca, electrical hyperexcitability, cramps, death). This substance appears to be identical with one that can be isolated from the lymphocytogenic tissue. The theory is therefore suggested that the spasmophilia of infants is due to a hyperfunction of the lymphocytogenic system. This system is, in so far as Ca metabolism is concerned, the antagonist of the parathyroids.

MILTON HANKE

The anticoagulant action of antithrombin. JOHN O. W. BARRATT. *Biochem. J.* 23, 422-4(1929).—The anticoagulant action of antithrombin upon a mixt. of fibrinogen (citrated plasma) and thrombin *in vitro* is exerted upon thrombin, which becomes diminished in amt. No evidence of any action upon fibrinogen was observed. B. H.

Observations on the carbohydrate metabolism of tumors. HERBERT G. CRABTREE. *Biochem. J.* 23, 536-45(1929).—The general result of these observations is to emphasize the difficulty of including the wide variations found in the carbohydrate metabolism of tumor tissue in one generalization.

BENJAMIN HARROW

Local immunization and anti-virus. NEWTON W. LARKUM. *Am. J. Pub. Health* 19, 1018-21(1928).—A brief review.

J. A. KENNEDY

The phenomenon of cholesterolized alcohol antigen precipitation in luetic sera. B. S. LEVINE. *Am. Med.* 35, 477-90(1929).—The difference in the results obtained by the various complement-fixation and antigen pptn. procedures is not due to any difference in the mechanism of the reaction of the involved substance. It is the difference in the concn. of the complex reagents used. Antigen pptd. as described by Kahn can be washed by a definite volume of an alcohol-saline soln. (1:1) without affecting its immunological properties. Addn. of distd. water to the antigen-saline serum after the latter has

been shaken for 3 to 5 min. causes the antigen to come out of suspension from negative as well as positive sera. This addn. of distilled water has no effect upon the immunological properties of the antigen.

FRANCES KRASNOW

The diagnostic value of blood studies in gastric disorders. D. A. KOGAN. *Arch. Verdauungs-Krankh.* 45, 381-9(1929).—In cases with ulcers there was a tendency to polycythemia, in cancer a lowering in the erythrocyte count and Hb or in Hb alone. Lymphocytosis was found in both disorders and seemed dependent on the activity of the processes.

FRANCES KRASNOW

Human isohemolysin. S. HIGUCHI. *Deut. Z. ges. gericht. Med.* 13, 428-40(1929).—The isohemolysin parallels the isohemagglutinin in the majority of bloods. Sera from which the autohemagglutinin has been removed show a higher titer than in normal sera. Sera inactivated by heating for 30 min. at 56° may be reactivated. The titer is then lower. Hemolysin is formed in the globulin fraction. It is lost by heating for 20 min. at 630°.

FRANCES KRASNOW

Mostagmin reaction. M. ASCOLI. *Bull. Nat. Research Council No. 69*, 27-36 (1929).—The lowering of surface tension (measured by the Traube stalagmometer) of dild. blood serum, resulting from antigen-antibody reactions, is called the "mostagmin" reaction. The reaction has been studied in order to differentiate blood from normal, as opposed to that from tumor, or other cases. The conditions for carrying out the reaction are so exacting that "for occasional practice in any laboratory the reaction is unsuitable."

W. D. LANGLEY

Some physicochemical characteristics of immune serum. P. LECOMTE DU NOÛY. *Bull. Nat. Research Council No. 69*, 146-69(1929); cf. *C. A.* 22, 3181.—From a study of the surface tension changes in the sera of 67 children "it is difficult to draw any conclusion except that it is probably impossible to find in a human being a serum entirely devoid of some kind of immunity, either natural or acquired." Serum of carefully selected rabbits shows a distinct drop in surface tension after injection of antibodies, which drop does not occur after injection of homologous cells or turpentine. The max. decrease is noted at about the 13th day after injection of the antibody. It seems, therefore, that the change of surface tension is related to the development of immunity in the rabbit.

W. D. L.

The calcium of the blood of normal sheep and of sheep without thyroid. P. V. BOTCHKAREFF AND M. P. DANILOVA. *Compt. rend.* 189, 304-5(1929).—It has been proved that complete parathyroidectomy of young sheep causes no symptoms of lack of parathyroidin and no lowering of blood Ca. The effect of thyroidectomy on blood Ca has not been detd. Comparisons were made of blood Ca of 20 sheep, from which the thyroid and internal parathyroids were removed at 1 year, with 23 normal sheep. Six tests, made at intervals of 1 week, by the method of Kramer and Tisdall, showed little variation. There was only a negligible difference between the 2 groups. The av. was about 10 mg. per 100 cc. blood.

AMY LEVESCONTE

The mechanism of phlorhizin diabetes. III. The effect of phlorhizin upon glycogen storage by dogs with ligated ureters. THOMAS P. NASH, JR. *J. Biol. Chem.* 83, 139-55 (1929); cf. *C. A.* 20, 1106.—"In a series of 18 dogs with ligated ureters, 12 of which were phlorhizinized, the sugar, non-protein N and acetone bodies of the blood, and the glycogen of muscle and liver were studied. No conclusive influence of phlorhizin upon any of these values could be demonstrated. It is suggested that this result is not necessarily inconsistent with the view that the mechanism of phlorhizin action is not restricted to the kidneys. Dogs which have fasted as long as 9 or 10 days, during which period and preliminary to ablation of kidney function they have been subjected to procedures (exposure, adrenaline administration, exercise) generally relied upon to reduce glycogen reserves to min. values, may still show substantially normal values for the glycogen content of muscles and liver." This finding contradicts the very general impression regarding an effective deglycogenizing routine which can be relied upon for establishing a control state.

A. P. LOTHROP

The calcium content of muscular tissue during parathyroid tetany. H. H. DIXON, H. A. DAVENPORT AND S. W. RANSON. *J. Biol. Chem.* 83, 737-9(1929).—The Ca content of the striped muscle of 9 parathyroidectomized dogs lies in the same range as that of 8 normal animals. A myogenic origin of tetania parathyreopriva is further negated by these findings.

A. P. LOTHROP

The behavior of hemolytic serum, complement-free hemolytic serum and normal serum in presence of chemical hemolyzers. KSHITISH CHANDRA SEN AND NARENDRA NATH MITRA. *J. Indian Chem. Soc.* 6, 155-70(1929); cf. *C. A.* 23, 3258.—Human serum dild. 1 in 10 in saline has been used as a source of hemolysins for sheep corpuscles in expts. on the hemolytic behavior of chem. hemolytes, saponin, taurocholate, oleate, acid and alkali. Both hemolytic and normal serum inhibit the hemolysis by chem. hemo-

lytes. Hemolytic serum in higher concn., although almost completely neutralizing the effect of chem. hemolytes, still retains some of its own hemolytic efficiency. Complement-free serum shows a greater inhibiting action on hemolysis but in higher concns. has no hemolytic action. Normal serum added to corpuscles either before addn. of hemolytes or with them inhibits hemolysis. When normal serum is added to a mixt. of hemolytes and corpuscles inhibition or acceleration of hemolysis can be obtained depending on the concn. of corpuscles, the hemolytes, the amt. of serum added and the time-interval before the serum is added. In the case of saponin no acceleration of hemolysis has been observed. Twenty-two tables are given. G. H. W. LUCAS

Hemolysis in sucrose solution and the behavior of normal serum in presence of chemical hemolytes. AMARESH CHANDRA ROY AND KSHITISH CHANDRA SEN. *J. Indian Chem. Soc.* 6, 171-80(1929).—The hemolytic effect of solns. of taurocholate, oleate and saponin and normal serum in sucrose was measured on sheep corpuscles washed repeatedly in isotonic sucrose soln. In taurocholate hemolysis abnormal time diln. curves were obtained with higher concns. of corpuscles and hemolyte. Lower concns. were analogous to saline solns. Saponin time-diln. curves were all normal. Inhibition of hemolysis was observed when normal serum was added to hemolytes or when normal serum and hemolyte were added to the corpuscles. Taurocholate and oleate inhibit or accelerate hemolysis, depending on the particular conditions of the expt. Sucrose solns. show results similar to those found with saline. Sixteen tables are given. G. H. W. LUCAS

Recent advances in the biology of cancer. HENRY JACKSON. *New Engl. J. Med.* 201, 294-303(1929); cf. *Medicine* 7, 345-82(1928).—A comprehensive review, with bibliography, covering the subjects of the chemistry of malignant disease, accessory food factors and chemotherapeutics. E. R. MAIN

Studies on diabetes. I. The reducing power of blood serum. GIULIO BUCCIARDI. *Boll. soc. ital. biol. sper.* 4, 446-8(1929); cf. *C. A.* 23, 4503.—The effect of insulin on the reducing power of free, potential, and protein sugar in blood serum was investigated. II. The index of refraction of blood serum. *Ibid.* 449-51.—The protein values of diabetic serum obtained from n_D detns. and those obtained from N detns. were compared. The % protein deduced from n_D measurements was always higher than that obtained from N detns. The difference was 1.45-2.6%. The non-protein N₂ in all cases was much higher than the av. value of normal sera. PETER MASUCCI

Studies on diabetes. III. Relation of water and protein in the serum. G. BUCCIARDI. *Boll. soc. ital. biol. sper.* 4, 568-70(1928); cf. preceding abstr.—The fluctuations in serum protein seen in pancreatic diabetes are inversely proportional to the variations in the hyperemia, in direct relation but not proportional to the quant. variations in urine output, and in inverse relation but not proportional to the variations in the body wt. G. H. SMITH

Flocculation in cerebrospinal fluids in cases of syphilis of the nervous system. GIOVANNI LANTERI. *Boll. soc. ital. biol. sper.* 4, 521-2(1929). PETER MASUCCI

The p_H of the blood determined by the potentiometric method. RENATO FACHIOLE. *Boll. soc. ital. biol. sper.* 4, 536-9(1929).—Numerous p_H detns. were made on various pathological bloods and the results obtained convinced P. that the blood tends to keep its H-ion concn. const., a requirement necessary for the life of the organism. Variations in the alk. reserve may be detected rather easily but changes in the p_H can be detected only in extremely grave cases and especially in the preagonal period. P. M.

The bile salts in hepatic pathology. ÉTIENNE CHABROL, HENRI BÉNARD AND M. BARIÉTY. *Presse méd.* [2], 36, 849-52(1928).—For the detn. of bile salts in blood, the Pettenkofer method was used, a spectroscope being applied. The absorption is near $\lambda 515$. This method uses furfural and H_2SO_4 and is sensitive to 0.1 g. per l. The surface tension detn. cannot be used in blood. In urine, the stalagmometric method was tried. Duodenal liquid can be tested by the stalagmometric method with reliability. In normal persons, the duodenal liquid contains 15 g. per l. The relation salt/pigment, the bile index, is on the av. 40. The ratio salt/cholesterol is 40. A physioli. salt cholemia is usually lower than 0.1 g. per l. In normal urine bile salts are never present. In jaundice by hyperhemolysis there is no change in the salts; the bile pigments only are increased. In icterus by retention the bile salts are not much increased, but pigments are high. Bilirubin is about 1 g. per l. In urine 0.2-1 g. bile salts are found. In jaundice, the cholesterol content in blood is increased to 3-4 g. Apparently, this hides the bile salts. As the circulation of the bile is disturbed, the organism rapidly becomes poor in bile salts and this also is responsible for the low content of them in the urine and the blood. In cancer of the liver, cirrhosis, pneumonia, scarlet fever and

typhoid fever bile salts are found in the urine. It is harmless to inject 2-3 g. of bile salts. In case of biliary disease, the pigments in the blood may be increased.

A. E. MEYER

Preparation of an immunizing serum against *Latrodectus mactans*. E. TROISE. *Rev. Soc. Argent. Biol.* 4, No. 6(1928); *Rev. sudamericana endocrinol. inmunol. quimioterap.* 12, 499(1929); cf. C. A. 23, 5240.—The spider poison is a true toxin. It is destroyed at 70–100° within 10 min. It has antigenic qualities.

A. E. MEYER

Lipemia in a case of severe seborrhea. PEDRO ESCUDERO *Semana méd* (Buenos Aires) 36, 353–5(1929).—In a case of chronic seborrhea, a hyperlipemia was observed with an increase of the fatty acids, cholesterol and lecithin. The carbohydrate metabolism was normal. A diet rich in carbohydrates, poor in protein and especially in fat aided by a treatment with *insulin* brought complete recovery.

A. E. MEYER

Studies on ketonuria. H. F. HÖST AND VICTOR BÜLOW-HANSEN, JR. *Acta Med. Scand.* 71, 325–49(1929).—By Van Slyke's method a physiol. ketonuria of 5–386 mg. per day was noted in a number of healthy individuals. In diabetic patients with a protein intake varying from 6 to 66 g. less ketonuria was found with quantities of 40–60 g. protein than with 6–20 g. The ketonuria varied with the fat intake. The patients were on diets with a ketogenic-antiketogenic ratio ranging from 1.5 to 5.0, but the ketonuria varied independently of this ratio. Insulin had no direct influence on ketonuria nor did the hyperglucemia. A febrile infection, on the other hand, caused a great increase in ketonuria.

S. MORGULIS

The problem of carbohydrate metabolism in pulmonary tuberculosis. ERIK LUNDBERG. *Acta Med. Scand.* 71, 493–520(1929).—The sugar tolerance of diabetics is improved through the development of tuberculosis. From tuberculous granulation tissue an ext. was prepd. which showed insulin-like action ("parainsulin") increasing the carbohydrate utilization. Similar preps. were successfully obtained also from carcinoma tissue. Tuberculous patients do not always show as low a blood sugar as might be expected. This is explained on the basis that an accessory endocrine organ does not generally manifest its presence by an overactivity, and the tuberculous tissue may be regarded as an accessory pancreas. The beneficial effect of insulin in the treatment of tuberculosis is attributed to the drastic interference with the nutrition of the granulation tissue, which should also be combined with the methods purporting to interfere with its oxidation processes.

S. MORGULIS

Problem of pathological fat formation. I. Does fat originate from protein? GEORG ROSENFELD. *Biochem. Z.* 209, 312–8(1929).—The older evidence against the view of the formation of fat from protein is reviewed and the theory is discussed according to which fatty degeneration of the liver is due to an infiltration. Further evidence is brought forth in favor of this theory in expts. on chickens made fat poor and given enormous quantities of glucide while being poisoned with P. The object of the glucide feeding is to note if it does protect fat which may possibly come from protein but disappears owing to its being metabolized. However, these expts. also showed that P does not cause a splitting off of fat from protein but only a migration of fat.

S. MORGULIS

The nature of the substance in the serum from anemic animals which influences the number of erythrocytes. A. ZIN. *Endokrinologie* 3, 81–4(1929).—The Carnot serum, ϵ , serum from animals with artificially induced anemia, produces its hemopoietic effect as well as hemolytic action in splenectomized animals. The substance appears in the serum even when the anemia is produced following the removal of the spleen. It cannot be therefore formed exclusively in the spleen.

S. MORGULIS

Relation of endocrine organs to the development of polycythemia and clinical types of polycythemia of hormonal origin. HANS GÜNTHER. *Endokrinologie* 4, 96–120(1929).—Erythropoiesis and particularly the development of polycythemia depend, relatively, most upon the adrenal cortex, then in lesser degree on sex glands, hypophysis and thyroid.

S. MORGULIS

The mechanism of complement fixation. HARRY EAGLE. *J. Gen. Physiol.* 12, 825–44(1929).—Complement fixation is obtained in every antigen-antibody reaction in which a heterogeneous phase is present or formed. The temp. coeff., velocity and quant. relationships of the reactants are those assocd. with adsorption process. All immune reactions *in vitro* involve an aggregation of immune-serum globulins upon the surface of the antigen. The "fixation" of complement is an adsorption of the aggregates so formed. It is not known whether this adsorption is detd. by the phys. state of the ppt. or by a sp. chem. affinity.

C. H. RICHARDSON

Mechanism of hemolysis by complement. I. Complement fixation as an essential preliminary to hemolysis. HARRY EAGLE AND GEORGE BREWER. *J. Gen. Physiol.* 12, 845–62(1929).—The film of immune serum protein deposited upon the cell during

sensitization acts as an adsorbent, the size of film detg. the amt. of complement "fixed" or adsorbed. Adsorption of complement by sensitized cells is an essential preliminary to hemolysis. The influence of electrolytes and H-ion concn. upon hemolysis is due principally to effects upon the fixation of complement by the sensitized cell. With salts having univalent cations, fixation and hemolysis are inhibited at concns. less than 0.02 *M* or greater than 0.35 *M*; electrolytes with bivalent cations are inhibitory at 0.07 *M*. The optimum p_H for fixation and hemolysis is 6.5-8.0; at slightly more acid reactions both are inhibited; whereas at p_H 5.3 and in the alk. range an irreversible inactivation takes place, becoming complete at p_H 4.8 and 8.8, resp. Complement fixation and hemolysis are prevented by the same factors that suppress the ionization of serum proteins and lead to increased aggregation; the analogy is too complete to be fortuitous. "If the mobilization of complement is the sole function of immune serum (as these expts. show) then the accepted terminology in which amboceptor, immune body and hemolysin are used synonymously is erroneous. The immune body would function only as an 'amboceptor,' mobilizing the effective hemolysin, complement, upon the surface of the cell." This adsorption probably concerns the so-called midpiece fraction of complement. C. H. RICHARDSON

Effect of cataphoresis on poliomyelitis virus. P. K. OLITSKY, C. P. RHODES AND PERRIN H. LONG. *J. Exptl. Med.* 50, 273-7(1929).—Under ordinary conditions of H-ion concn. the virus of poliomyelitis, as such, or associated with particles in fine suspensions, migrates in an elec. field to the anode; it follows that the virus bears an electro-negative charge. By means of cataphoresis, the virus can be recovered from a non-infective mixt. of virus and sp. immune serum. C. J. WEST

Relation of vaccinal immunity to the persistence of the virus in rabbits. PETER K. OLITSKY AND PERRIN H. LONG. *J. Exptl. Med.* 50, 263-72(1929); cf. *C. A.* 23, 1955.—By means of cataphoresis vaccine virus can be obtained from suspensions of tissue which are inactive by the usual tests of animal inoculation. Active virus can be obtained by this method from tissues of rabbits long recovered from the effects of cutaneous vaccination. C. J. WEST

Effects of loss of gastric and pancreatic secretions and the methods for restoration of normal conditions in the body. ALEXIS F. HARTMANN AND ROBERT ELMAN. *J. Exptl. Med.* 50, 387-405(1929).—The compn. of gastric and pancreatic juices and the effects of their loss on the compn. of the body fluids were studied. Loss of gastric juice by removing H_2O and Cl ions only partly neutralized by fixed bases results in dehydration and alkalosis. Loss of pancreatic juice by removing H_2O and a relative excess of fixed base results in dehydration and acidosis. Normal conditions in the body may be restored after the loss of either gastric or pancreatic juice by the administration of a combined soln., which provides H_2O in abundance because of its hypotonicity, an adequate source of the fixed anion Cl^- and of the cations Na^+ , K^+ and Ca^{++} in proper physiol. ratio and an excess of fixed base over fixed acid in the form of B -lactate. C. J. WEST

Hydrogen-ion concentration and filterability of vaccine virus. HIDETAKE YAOI AND HISAO KASAI. *Proc. Imp. Acad. (Japan)* 5, 274-6(1929).—An active filtrate was invariably obtained from suspension corrected to p_H 8.0, while filtrations performed under the reaction of p_H 6.0 or 7.0 yielded no or very small amts. of the virus; thus the adsorption on filter candle can be lessened by properly regulating the reaction of suspensions. C. J. WEST

WELLS, H. GIDEON: The Chemical Aspects of Immunity. 2nd ed., revised and enlarged. A. C. S. Monograph 21. New York: The Chemical Catalog Co. 286 pp. \$6. Reviewed in *Ind. Eng. Chem.* 21, 991(1929).

H—PHARMACOLOGY

A. N. RICHARDS

The value of different amino alcohol esters of the aromatic saturated carboxylic acids as local anesthetics. KAGEMASA KUWAHATA, AKIRA OCHIAI AND YOSHIMIDE NUKITA. *Folia pharmacol. japon.* 7, 408 21(1928); *Ber. ges. Physiol. exptl. Pharmacol.* 48, 128; cf. *C. A.* 23, 2499.—The preps. which were tested on the skin of the guinea pig were: benzocaine (benzoyl- β -diethylaminoethanol- HCl), anisocaine (p -methoxybenzoyl- β -diethylaminoethanol HCl), helicaine (piperonyl- β -diethylaminoethanol- HCl), phenaceaine (phenylacetyl- β -diethylaminoethanol- HCl) and hydroapocaine (phenylpropionyl- β -diethylaminoethanol- HCl). All are slightly sol. in H_2O . The solns. reacted neutral and showed local anesthetic action which increased in the following order: phenaceaine < hydroapocaine < anisocaine < helicaine < benzocaine. The last

is almost as active as cocaine, while the others are less active than novocaine. The toxicity as detd. in mice by subcutaneous injections increases in the following order: anisocaine < helicinae < benzocaine < phenaceaine < hydrocaine.

R. C. WILLSON

Influence of a small quantity of potassium bromide orally administered on the internal organs with special regard to thyroid gland. M. MINOWADA. *Acta Dermatol.* (Kyoto) 11, 381-5(1928); *Ber. ges. Physiol. exper. Pharmacol.* 48, 284.—Mature pigeons received 20 cc. 1% KBr soln. daily for 50 days. The epithelial cells of the thyroid gland were clearly increased. This condition was combined with hyperemia and indicated a higher functional activity of the organ. Changes were not found in the other internal organs.

R. C. WILLSON

The active principle of chamomile flowers. KARL JUNKMANN AND W. WIECHOWSKI. *Arch. exper. Path. Pharmacol.* 144, 1-7(1929).—The active principle of the flowers of *Chamomilla vulgaris* is a glucoside, which in moderate doses depresses intestinal motility due to an increased sensitivity of the intestine to inhibiting impulse. Larger doses of the glucoside directly paralyze the intestine by acting on the smooth muscles.

B. C. BRUNSTETTER

Increasing the activity of magnesium salts and its application to enteric narcosis. S. LIEBEN. *Arch. exper. Path. Pharmacol.* 144, 61-70(1929).—Injection of a subnarcotic dose of a Mg salt followed 24 hrs. later by the same dose produces complete narcosis. Owing to the first injection the second has a smaller Ca antagonism to counteract. Substitution of MgCl₂ for MgSO₄ and admixt. with bile makes possible (by oral or rectal administration) efficient narcosis of large animals such as sheep and ox.

B. C. B.

The effect of acetylcholine on glucemia. MARCEI IALBÉ, FL. NEVEUX AND L. JUSTIN-BESANÇON. *Compt. rend. soc. biol.* 100, 795-6(1929).—Acetylcholine (0.02 g.) was subcutaneously injected into 8 humans (fasting). Detrus of blood sugar at short intervals for 2 hrs. showed a pronounced hypoglucemia, with a return to normal at the end of 2 hrs.

B. C. BRUNSTETTER

Investigations of isolated bronchial muscle. Action of the sympathetic and parasympathetic systems. MAURICE VILLARET, L. JUSTIN-BESANÇON AND VEXENAT. *Compt. rend. soc. biol.* 100, 806-8(1929).—Excitants of the sympathetic system relax isolated bronchial muscle. The action of adrenaline is very powerful; ephedrine exerts an effect much less marked and rapid. Ergotamine tartrate contracts bronchial muscle and can counteract adrenaline. Excitants of the parasympathetic system contract bronchial muscle, acetylcholine being the most powerful tested. A feeble dose of atropine, a paralyzer of the parasympathetic system, can counteract even a strong dose of acetylcholine.

B. C. BRUNSTETTER

The effect of phenylethylmalonylurea, of cicutine and of arsenobenzenes on isolated bronchial muscle. MAURICE VILLARET, L. JUSTIN-BESANÇON AND VEXENAT. *Compt. rend. soc. biol.* 100, 809(1929).—Phenylethylmalonylurea in doses of 0.01-0.10 g. per 200 cc. Locke soln. has no effect on isolated bronchial muscle, indicating that in the crisis of asthma this substance acts through the central nervous system. Hemlock alkaloids, in particular, cicutine-HCl, contract bronchial muscle much less than excitants of the parasympathetic system. Arsenobenzenes such as Na dihydroxydiaminoarsenobenzenemethylenesulfonate produce no effect on isolated bronchial muscle in doses of 0.01 g. per 200 cc. Locke soln. but in doses of 0.10 g. per 200 cc. there is a short contraction, followed by a slight relaxation and death of the muscle.

B. C. BRUNSTETTER

The effects of acetylcholine on pancreatic secretion. MAURICE VILLARET, L. JUSTIN-BESANÇON AND ROGER EVEN. *Compt. rend. soc. biol.* 101, 7-8(1929); cf. *C. A.* 22, 2891.—Acetylcholine chloride (0.01-0.04 g. per kg.) was subcutaneously injected into fasting dogs. After 2-5 min., 1-2 cc. of secretion was collected from a cannula in the canal of Wirsung. This juice contains a lipase, an amylase and a trypsin. Diffuse pancreatic hemorrhage was produced, after ligation of the canal of Wirsung by both subcutaneous and intravenous injections of the above doses of acetylcholine.

B. C. BRUNSTETTER

The influence of the thyroid hormone upon the metabolism of work of the dog. BURKHARD KOMMERELL. *Arbeitsphysiol.* 1, 586-94(1929); cf. *C. A.* 23, 3958.—The efficiency of the performance of work by a dog upon an inclined treadmill was studied by means of the Douglas bag method before and after the ingestion of thyroxine and dried thyroid gland. Thyroxine did not lower the efficiency and there was no difference between the effect of thyroxine and the dried gland.

T. M. CARPENTER

The action of several alkaloids on isolated leucocytes. C. FORTI. *Atti accad. Lincei* 9, 840-6(1929); cf. *C. A.* 20, 3190; 22, 2211.—Continuing a study of the action of the different alkaloids (*in vitro*) on leucocytes, F. adds various concns. of cocaine,

cocaine-HCl, *novocaine*, *tulocaine* and *nicotine* in sterile isotonic NaCl soln. to which blood from *Bufo vulgaris* was added 1 to 10. The slowing down and final stop of the amebic movements were compared with blanks. With *cocaine*, 1:1000, action was arrested in 12 days, with 1:700, in 8 days; *cocaine-HCl*, 1:1000 in 8 days, 1:500 in 4 days, 1:250 in first day; *novocaine* 1:500 in 11 days, 1:150 after 9 hrs.; *tulocaine* 1:1000 in 4 days, 1:250 in 2 days; *nicotine* 1:4000 in 9 days, 1:1000 in 8 days, 1:500 in 6 days. *Cocaine-HCl* and *cocaine* are, therefore, most toxic, and *nicotine* is least toxic.

A. W. CONTIERI

Treatment of definite forms of pulmonary tuberculosis with Lopion, the gold thiourea combination. KURT HENTUS AND WISSING. *Beitr. Klin. Tuberk.* **69**, 597-605(1928).—In animal expts. and on cases of pulmonary tuberculosis in man the authors used a new Au compd., "Lopion," a Au thiourea compd. contg. about 42% Au. This prepn. proved less toxic and better tolerated than any of the newer Au prepn. tested. The material is given intravenously for a period of 1½ to 8 months, at intervals of 2 to 8 days, in doses of 0.05 to 1.0 g. to a total of 2.5 to 15 g. Two markedly active febrile cases and 8 chronic indurative productive cases of pulmonary tuberculosis were treated. With the exception of 1 case given a total of 7.6 g. all the patients showed improvement. No exanthemata or undesirable kidney or general effects were noted. The advantage of the prepn. lay in the fact that it deposited primarily in the liver and, therefore, unlike Sanocrysin, Solganol and other Au combinations, had no effect upon the kidneys.

H. J. CORPER

New chemotherapeutic procedure in pulmonary tuberculosis. WILHELM MÜLLER. *Z. Tuberk.* **51**, 203-9(1928).—See C. A. **23**, 932.

H. J. CORPER

Metal salt therapy and prophylaxis of tuberculosis. L. E. WALBUM. *Z. Tuberk.* **51**, 209-22, 273-90(1928); cf. C. A. **22**, 3222.—An extensive report of the effect of various metal salts and compds. is presented by Walbum as a result of numerous tests in rabbits and guinea pigs especially, to det. the effect upon tuberculosis. Walbum does not claim that these salts act directly upon the infecting microbe but believes that they act upon the cells of the animal organism either as an irritant or as a catalyzer affecting certain enzymic processes in the cells.

H. J. CORPER

Therapeutic experiments with ultra-violet-irradiated chocolate. H. KRASSO. *Wiener klin. Wochschr.* **42**, 898-9(1929).—Favorable results in various diseases were obtained.

D. B. DILL

Toxicity of raw beans and bean embryos. H. FASCHINGBAUER AND L. KOFLER. *Wiener klin. Wochschr.* **42**, 1069-72(1929).—Two cases of phasin poisoning are described from eating 10 and 3 resp. germinating fire beans (*Phaseolus coccineus*). There was acute gastroenteritis, liver distension and urobilinuria. Feeding expts. with mice indicated that phasin content of fire beans is no greater than that of garden beans and that young embryos of the fire bean contain about as much phasin as ungerminated fire beans.

D. B. DILL

Effect of excessive dosages of thyroid on the domestic fowl. J. HOLMES MARTIN. *Biol. Bull. Marine Biol. Lab.* **56**, 357-70(1929)

FREDERICK G. GERMUTH

Tetrachloroethylene in the treatment of hookworm disease. P. A. MAPLESTONE AND A. K. MUKHERJI. *Indian Med. Gaz.* **64**, 424-6(1929).

F. G. G.

The use of fibrolysis in leprosy. NORBERT FIGUEROA. *Indian Med. Gaz.* **64**, 426-9(1929).—It failed to produce any signs of improvement after a continuous trial of 4 months, in 9 old cases; also in 1 case of 2 years' standing.

FREDERICK G. GERMUTH

Perorally active compounds of insulin with bile acids. BERNHARD STUBER AND KONRAD LANG. *Naturwissenschaften* **17**, 546(1929).—In weakly alk. soln. condensation products of insulin with cholic and desoxycholic acids were prepd. They have a strong insulin action on peroral application, almost as much as subcutaneous. The expts. were done on rabbits, dogs and men. The doses are large compared with the original insulin (200 to 300 units); therefore practical use is as yet prohibited. It is assumed that the compds. have an acid amide bond; insulin choleic acid prepd. from insulin and Na desoxycholate is quite inactive perorally.

B. J. C. VAN DER HOEVEN

Physiological response attending exposure to vapors of methyl bromide, methyl chloride, ethyl bromide and ethyl chloride. R. R. SAYERS, W. P. YAUT, B. G. H. THOMAS AND L. B. BERGER. *U. S. Pub. Health Bull.* No **185**, 1-56(1929).—The purpose was to det. the effects of these vapors escaping in refrigeration plants. Guinea pigs were used. Short exposure to high concns. of the vapors produced similar symptoms, anesthetic in character—excitement, rapid loss of equil., struggling and running motion of the legs, followed by rapid recovery of those animals which had not died in the chamber. With low concn. of vapor and long exposure, the symptoms were also similar—weakness, rapid pulse, convulsive, rapid respiration, with rales, and in some cases a

frothy bloody exudate from the nostrils, followed usually by death in 1-4 days. EtCl is the least toxic and MeBr the most. Addn. of chem. agents to these refrigerants to serve as a warning on escape is suggested.

G. H. W. LUCAS

The central action of carbon monoxide. MICHELE MITOLO. *Boll. soc. ital. biol. sper.* 4, 459-61 (1929).—The direct action of CO on the nerve centers of Baglioni's prepn. was studied. H_2O_2 was used as a source of O_2 for the centers. CO caused the paralysis of the centers in $\frac{3}{4}$ hr. The paralysis was always preceded by a net increase in excitability which at times reached a state of tetany. If the prepn. was removed from the influence of CO, and placed in the ice-box at 6° in the presence of H_2O_2 , the reflex activity reappeared after $\frac{1}{2}$ to 1 hr. M. considers the acute asphyxia of the centers which took place in the presence of O_2 as of toxic origin, namely, by the direct action of CO on the central elements.

PETER MASUCCI

The action of alcohol on the production of energy at the temperature of thermal neutrality. IRANIMIRO MALES. *Boll. soc. ital. biol. sper.* 4, 465-7 (1929).—EtOH 95%, undil., administered in small doses to rats increased the metabolism about 25% during the first hr. The same quantity of alc. administered in a dil. form did not increase but rather decreased the O_2 consumed.

PETER MASUCCI

Studies on magnesium. I. The narcosis from magnesium. RENZO AGNOLI. *Boll. soc. ital. biol. sper.* 4, 484-5 (1929).—It was not possible to produce narcosis in dogs by injections of Mg salts. By increasing the doses, 2 g. per kg. of $MgSO_4$ and 3 g. per kg. of $MgCl_2$, fatal toxic symptoms were obtained without producing narcosis. In dogs with parathyroidectomy accompanied by hypocalcemia and hypomagnesemia, the sensitiveness to Mg was increased without, however, producing narcosis.

PETER MASUCCI

Narcosis from magnesium and acid-base equilibrium. EMILIO MARTINI. *Boll. soc. ital. biol. sper.* 4, 486-8 (1929).—The diminution of the alk. reserve artificially provoked in rabbits and guinea pigs increases markedly the latent period of narcosis from Mg injections. The injection of Mg salts increases the alk. reserve about 20%, which gradually becomes reduced to below the initial value during the narcosis. Successive injections of Mg salts increase further the latent period of narcosis. If the alk. reserve is increased by the subcutaneous injection of $NaHCO_3$, the latent period is decreased but the narcosis is more profound and lasting.

PETER MASUCCI

New studies on thyroxine. EMILIO MARTINI. *Boll. soc. ital. biol. sper.* 4, 489-91 (1929).—Thyroxine administered intravenously does not manifest a const. action on the deaminizing process. The behavior is similar in parathyroidectomized animals. I_2 in small doses (0.5 mg. per kg.) produces an action analogous to that of thyroxine on deaminizing processes.

PETER MASUCCI

The biological action of lanthanum on smooth muscles, particularly on the uterus. OSCAR M. BERNARDI. *Boll. soc. ital. biol. sper.* 4, 493-6 (1929).—Small doses (1 to 2 cc. 1% $La(NO_3)_3$ in 80 cc. Ringer soln. without $NaHCO_3$) produce a slight increase in tone without any effect on contractions. Doses of 1 cc. 5% $La(NO_3)_3$ in the same quantity of Ringer soln. produce a noticeable lowering of tone with the disappearance of contractions which if the action is not too prolonged return to normal on repeated washing with Ringer. Large doses, 3-5 cc. 5% $La(NO_3)_3$ to 2-5 cc. 10% $La(NO_3)_3$, produce a marked increase in tone or contracture with disappearance of contractions which do not reappear on repeated washing with Ringer.

PETER MASUCCI

The pharmacologic action of sea water. II. The immediately lethal minimal dose of sodium chloride in intravenous application. ANGELO RABBENO. *Arch. sci. biol. (Italy)* 13, 399-406 (1929); cf. *C. A.* 23, 201.—A 3.5% soln. of NaCl was used for intravenous injection in the rabbit. The tolerance is high at slow injection (166.8 cc. per kg. at about 0.5 cc. per minute and kg.). It decreases with higher velocity to a min. of about 135 cc. at a velocity of 1.7 cc. A max. of 186.9 is reached again at 2.8-cc. velocity and a second min. of 98.7 cc. at 3.5-cc. velocity. Later it arises continuously. Sea water has the first min. of 123 cc. at 1.45-cc. velocity, the following max. (139 cc.) at 1.85 velocity and the second min. of 100 cc. at 3.00-cc. velocity. On the av., sea water is twice as toxic as NaCl.

A. H. MEYER

The influence of adrenaline, pilocarpine or atropine on the patellar reflex. PIETRO MOLteni. *Arch. sci. biol. (Italy)* 13, 407-20 (1929).—Intravenous injection of adrenaline, pilocarpine or atropine causes a decrease of the patellar reflex. It is supposed, that with adrenaline, this effect depends on the vasoconstrictor effect, with pilocarpine on a reduction of the excitability of the reflex centers, and with atropine on the excitation of the cerebral cortex.

A. E. MEYER

Mineral water as an antitoxic medium; role of calcium. P. L. VIOLE and ANDRÉ GIBERTON. *Presse méd.* 37, 943-4 (1929).—Mineral waters are able to neutralize the lethal dose of some poisons, when injected at the same time. The action of colloidal

Cu soln., prepd. by the action of pure H_2O on metallic Cu, on fishes was studied. The addn. of mineral water preserved the life of the animals while the controls died. The effect is due to the Ca. Sparteine is neutralized by Ca when injected in guinea pigs, but no effect was obtained against diphtheria poison. SiO_2 in colloidal soln. is inefficient. A. E. MEYER

Pharmacologic study of the poison of *Latrodectus mactans*. E. TROISE. *Rev. soc. Argent. biol.* 4, No. 6(1928); *Rev. sudamericana endocrinol. inmunol. quimioterap.* 12, 597(1929); cf. *C. A.* 23, 5235.—The poison of *Latrodectus mactans*, a spider very common in America, produces in the dog an increase of the blood pressure, diuresis, hypoglycemia, leucopenia, hyperglobulia and an increase of the hemoglobin. The poison is inactive after being heated to 100° for 10 min. A. E. MEYER

The use of treparsol by oral administration in the treatment of syphilis. ENRIQUE P. FIDANZA, JOSÉ M. FERNÁNDEZ AND LUIS MARTÍNEZ E. *Semana méd.* (Buenos Aires) 36, 286-320(1929).—Treparsol, a formyl deriv. of *m*-aminohydroxy-*p*-phenylarsonic acid, was given by mouth in doses of 1.75-4 g. weekly, distributed over the days of the week in increasing amounts. The method is recommended as a substitute for a series of injections. The influence on the symptoms and the blood test were good. A. E. MEYER

Biological action of thallium acetate. GIOVANNI TRUFFI. *Arch. sci. biol.* (Italy) 13, 271-319(1929).—See *C. A.* 23, 2491. E. C. M.

Some notes on the history of mercury intoxication. JOHAN ALMKVIST. *Acta Med. Scand.* 70, 464-76(1929). S. MORGULIS

The effect of β -tetrahydronaphthylamine on the white blood cells of rabbits. GUSTAV HÖGLUND. *Acta Med. Scand.* 70, 573-89(1929).—Injections of 0.01-0.04 mg. β -tetrahydronaphthylamine causes an increase in the no. of white cells, particularly of neutrophils, the same effect being noted in animals deprived of their heat regulating mechanism by sectionizing of the cord. This increase is only found in the veins S. MORGULIS

Treatment of diabetes by insulin. ERIK LUNDBERG. *Acta Med. Scand.* 71, 29-37(1929). S. MORGULIS

Acute aniline poisoning. JAKOB MÖLLERSTRÖM. *Acta Med. Scand.* 71, 73-81(1929).—In a case of acute poisoning with aniline this was found in free form in the urine. S. MORGULIS

A clinical study of caffeine intoxication. RICHARD ERHARDT. *Acta Med. Scand.* 71, 94-114(1929). S. MORGULIS

Fatal cases of poisoning with acetylsalicylic acid. G. HULTKVIST. *Acta Med. Scand.* 71, 165-9(1929). S. MORGULIS

The mechanism of the ammonium chloride acidosis. ASBJORN FOLLING. *Acta Med. Scand.* 71, 221-79(1929).—Ingestion of NH_4Cl in sufficient quantities produces a marked acidosis, the pH of the arterial blood falling to 7.16 and 7.22 in 2 cases. Before entering the blood all of the NH_4Cl undergoes transformation and acts as an equiv. quantity of HCl . In the blood and tissues this acid is temporarily neutralized by the bicarbonate. The excretion in the urine occurs partly through preliminary reaction with Na_2HPO_4 and partly in combination with free base obtained from the alk. reserve. The latter lasts only a short time so that through subsequent retention of base the body reaction comes back to normal. The most important means of neutralizing the excreted acid is the NH_3 . In general 10-20% of the total acid is excreted free, the fixed base being used only temporarily and returned to the organism during the recovery period. The remaining 80-90% are neutralized by NH_3 . The NH_4Cl has a diuretic action which continues as long as the ingested acid is being excreted bound by fixed base, but later both salts and water are retained by the body. The diuresis is of the nature of a diln. diuresis. The NH_3 used for the neutralization is formed in the kidney, increasing with increasing amts. of acid to be excreted and ceasing when the urine becomes somewhat more alk. than the blood. The blood NH_3 concn. remains const. all the time. S. MORGULIS

Additional investigation into the effect of insulin on the respiratory metabolism. CAR HOLTEN. *Acta Med. Scand.* 71, 285-300(1929).—The respiratory quotient following insulin injections increases about twice as much in a normal individual as it does in a diabetic, while the blood sugar change is much greater in the latter (53 mg. % against 20 mg. %). Insulin does not alter the heat production in normal individuals but it must be assumed that it lowers the heat production of diabetics. In diabetics 14-24 hrs. after the injection of insulin the respiratory quotient is higher than that corresponding to the actual catabolic processes, probably owing to a synthesis of fat from carbohydrates.

The decrease in energy consumption which insulin appears to cause in diabetic but not in normal individuals is perhaps connected with the cessation of this synthesis.

S. MORGULIS

The similarity of action of sodium fluoborate and sodium perchlorate on the skeletal muscles. GUNDO BOEHM. *Biochem. Z.* 209, 489-91 (1929).—Both NaBF_4 and NaClO_4 produce identical contracture reactions in muscle which are attributed to the similarity in the structure of the 2 anions.

S. MORGULIS

Experimental complex formation therapy in cases of chronic lead and mercury poisoning. HERBERT LUDWIG. *Biochem. Z.* 210, 353-92 (1929).—The complex affinity of Hg ions toward KI is much greater than for Pb ions. The pptn. zone for Hg is very narrow and for Pb, on the contrary, very wide. Likewise, the complex affinity for $\text{Na}_2\text{S}_2\text{O}_3$ is greater for Hg, which has greater affinity for S than for Pb ions. With cysteine the formation of HgS predominates over that of PbS so that the affinity for the SH group is also greater. However, with proteins the formation of PbS is greater than that of HgS , because here one deals in addn. with the preponderant affinity of the NH_2 group. In serum the conditions are different. The PbS formation with the proteins here is less than the HgS formation, and is less than the PbS formation either with ovalbumin or serum albumin solns. It follows, therefore, that in the serum the PbS formation is inhibited which is also manifested by the inhibition of the reaction of Pb with $(\text{NH}_4)_2\text{S}$, and it is concluded that part of the Pb must be present in serum in a less reactive form. Since this inhibition of reactivity of Pb in serum is very pronounced and in cases of intoxication the quantity in the circulation is very small it is suggested that the Pb in serum is found entirely in this slightly active form. The inhibiting effect is not seen in serum deproteinized either with $(\text{NH}_4)_2\text{SO}_4$ or with CCl_3COOH . The affinity of ovalbumin for Pb cannot be decreased through the addn. of CO_2 , PO_4 or glucose. Serum retains its inhibiting action after shaking with ether. The complex salt formation with KI inhibits the reactivity of the Hg salts somewhat more than that of the Pb salts, but this effect is so slight that it can be noted only with the $\text{Na}_2\text{S}_2\text{O}_3$ but not with $(\text{NH}_4)_2\text{S}$. The affinity of Hg for NH_2 is greater than that of the Pb but the affinity for I_2 is so much greater that HgI_2 is more poorly sol. in glycochol than PbI_2 , and KI breaks up the combination of Hg with NH_2 . Pb has a much stronger affinity for the OH than Hg. In serum both Hg and Pb salts dissolve more or less readily and equally. The complexes with KI have a protein-pptg. action as anions, pptg. proteins only in an acid medium just as $\text{K}_4\text{Fe}(\text{CN})_6$. They also shift the opt. pptn. point of casein toward the alk. side more than KSCN and less than $\text{K}_4\text{Fe}(\text{CN})_6$ or $\text{K}_3\text{Fe}(\text{CN})_6$. Hg and Pb salts added to serum are very slightly dialyzable, and KI even in large concn. does not promote the dialyzability. In yeast fermentation expts. $\text{Hg}(\text{NO}_3)_2$ is found to be much more toxic than $\text{Pb}(\text{NO}_3)_2$, and the KI complex with Hg is no less toxic. The toxicity of the KI complex with Pb could not be definitely detd. The difference in reaction toward KI of the organism poisoned by Pb or Hg is thus clear. KI brings more of the deposited Hg into soln. and also frees it from its combination with the NH_2 groups of the protein. This complex salt, however, is very toxic which explains the contraindication of KI in the treatment of chronic Hg poisoning. On the contrary, treatment with Sr thioacetate is recommended because this produces less complexes. Pb, on the other hand, is but slightly mobilized by the KI, and since it does not increase the reactivity or soly. of the Pb salts in serum its administration increases the elimination of Pb without endangering the organism. Untoward results in the Pb poisoning with KI are attributed to a simultaneous Hg intoxication. S. M.

Some pharmacological properties of the alkaloid of Banisteria Caapi. RAYMOND-HAMMET. *Compt. rend.* 188, 1519-21 (1929).—Three alkaloids of similar characteristics (named telepathine, yajeine and banisterine) have been prepd. from trees of the spruce family. By intravenous injection of an anesthetized dog, it is shown that telepathine produces distinct hypertension; injection of yajeine provokes hypertension, but the pressure falls slowly. Telepathine in feeble doses retards respiratory rhythm, in strong doses, accelerates it. While the hypertensive action of small doses of adrenaline is suppressed by previous administration of telepathine, the vaso-constrictor effect is not modified. The alkaloid has no apparent effect upon the respiratory wave; it causes an inhibition of intestinal contraction.

N. M. NAYLOR

Studies on magnesium. III. Influence of narcotics upon magnesium in the blood. RENZO AGNOLI. *Boll. soc. ital. biol. sper.* 4, 579-81 (1929).—In expts. on dogs the Mg of the blood was diminished in almost every instance.

G. H. SMITH

Influence of cobalt on nitrogen excretion. P. MASCHERPA. *Boll. soc. ital. biol. sper.* 4, 582-6 (1929).—Repeated small doses of Co administered *per os* to dogs stimulated N output.

G. H. SMITH

Action of Japan camphor upon the heart. II. The fate of camphor in the body

and the action of its intermediate products. KENZO TAMURA AND GYOKUJO KIHARA. *Proc. Imp. Acad. (Japan)* 5, 294-6(1929); cf. *C. A.* 22, 1411.—The action of campherol, *p*-hydroxycamphor, *o*- α -hydroxycamphor, their glucosides and glucuronic acids, camphoric acid, camphor and quinine upon the heart is reported briefly. The substance to which the action of camphor as a cardiac stimulant is to be attributed has not been found among the intermediate products formed or seem to be formed in the body before it is finally excreted as glucuronic acid derivs. The facts that the stimulant effect of camphor upon the heart appears only after some latent period and that it is ineffective when a minute quantity of quinine is present, suggest the stimulation of the heart by some unknown intermediate product formed in some other possible course than those in which camphor is excreted finally as *p*- and *o*- α -hydroxycamphorglucuronic acids. C. J. W.

Hg in chemistry and pharmacy. III. Medicinal and organic mercurials (Dyson) 2. Gentian (REDGROVE) 17. The halogen substitution products of thyronine (SCHUB-GRAF) 10. The bromination of some natural alkaloids by the hydracid-H₂O₂ mixture (MOREL, *et al.*) 10. The bromination of novocaine by the hydracid-H₂O₂ mixture (MOREL, *et al.*) 10.

CAZZANI, U.: *La ipodermoterapia nella tecnica farmaceutica e nella pratica medica*. Milan: Istituto Sieroterapico Milanese. 553 pp. L. 40. Reviewed in *Chimie & Industrie* 22, 436(1929).

I—ZOOLOGY

R. A. GORTNER

The effect of the physicochemical characteristics of the environment on pigment evolution and the physiological state of the eel. A. PANU. *Compt. rend. soc. biol.* 101, 279-81(1929).—Pigmentation is inversely proportional to the O₂ content of the medium and directly proportional to the temp. The optimum acidity for pigmentation is that of fresh water, *p*_H 7.1-7.4, and the optimum light condition is diffuse light. While eels are in fresh water, there is a decrease of NaCl in their blood, a tissue hydration and a wt. reduction.

The composition of the meconium of Lepidoptera. ANDRÉE COURTOIS. *Compt. rend. soc. biol.* 101, 365-6(1929).—The meconia excreted shortly after birth by individuals of *Attacus pernyi*, *Saturnia pyri* and *Sphinx ligustri* were separately dried and analyzed. The following figures, expressed as % of the dry wt., were obtained: uric acid 23.0-26.2, NH₃ 0.3-1.2, amino N 2.7-3.1, urea traces, P 1.9-2.5.

The oxidation-reduction potential in fly larvae (*Phormia regina*). E. ABDEL AND ROBERT LEVY. *Compt. rend. soc. biol.* 101, 1019-20(1929); cf. *C. A.* 23, 4745. Using the technic reported in the expts. on butterfly larvae, E. and L. found similar results for fly larvae. In N₂, the *r*_H was about 7; in air, the *r*_H was a little less than 20. Fly larvae injected with the various dyes and stored in N₂ required a longer time to decolorize than did the butterfly larvae; nor were they immobilized in N₂.

The effect of ammonium salts on protoplasm of ameba. FLOYD J. BRINLEY. *Biol. Bull. Marine Biol. Lab.* 56, 371-8(1929).—The toxicity of certain ammonium salts is apparently due to their action on the plasma membrane and not on the internal protoplasm. The ultimate effects of these salts are essentially due to the cations, but may be modified by the anions.

The respiratory metabolism of *Balanus crenatus* with varying salt content of the external environment. I. The oxygen consumption with varying salt content of the surrounding water. EUGEN KREPS. *Arch. ges. Physiol.* (Huger's) 222, 215-41(1929). III. The oxygen consumption in air with varying salt content of the body fluids of *Balanus balanoides*. VERA BORSYK AND EUGEN KREPS. *Ibid.* 371-80.—The O consumption of *Balanus balanoides* in air is dependent on the salt concn. of its internal environment.

The respiratory proteins of the blood. IV. The buffer action of hemocyanin in the blood of *Limulus polyphemus*. ALFRED C. REDFIELD, GEORGE HUMPHREYS AND ELIZABETH INGALLS. *J. Biol. Chem.* 82, 759-73(1929); cf. *C. A.* 22, 2793. The properties of hemocyanin as influenced by its electrolytic environment account for the buffer phenomena of *Limulus* blood. Natural *Limulus* serum contains 18 to 37 $\times 10^{-6}$ mols. of base, in excess of acid, per g. of hemocyanin.

Scyllitol in selachian ontogeny. JOSEPH NEEDHAM. *Biochem. J.* 23, 319-23(1929).—In investigating the scyllitol of the undeveloped eggs and fully developed embryos of the selachian fish, *Acanthias vulgaris*, it was found that just as the chick has to synthesize during its ontogeny 90% of the inositol with which it hatches, so the dogfish has to synthesize 90% of its scyllitol.

BENJAMIN HARROW

The chemical anatomical viewpoint in zoölogy. CURT HEIDERMANNS. *Naturwissenschaften* 17, 437-42(1929).—A review. B. J. C. VAN DER HOEVEN

The influence of the environmental temperature on the nutrition state of fish during hibernation. CHR. BRUNNER AND H. ENDRESS. *Z. Biol.* 89, 85-113(1929).—The fat and protein requirements increase with increase in temp and fall with decrease in temp. The loss varies with the organ; the muscles and viscera lose much more than the skin and skeleton. The compn. of the animal changes. There are decreases in dry substance, fat and N; there are small increases in ash, rest N and water. F. K.

The digestive enzymes in the so-called pancreatic gland of *Balanus perforatus*. L. PATANÉ. *Arch. ital. biol.* 80, 14-9(1928).—The gland of the *Balanides* generally designated as the pancreas contains an amylase, a sucrase and a lipase (of the esterase type). The presence of a proteolytic enzyme has not yet been established. The function of this gland is primarily concerned with carbohydrate and probably also fat digestion. S. MORGULIS

Cervical sympathicotomy and respiration. II. Effects of cervical sympathicotomy on the gaseous exchange of the lungs and the circulation in the pulmonary vein of the decerebrated turtle. GIURIO PUPILLI. *Arch. ital. biol.* 80, 116-29(1928).—Physiological. S. MORGULIS

The inorganic constituents of the blood from butterfly pupae (*Sphynx pinastri*, *Pieris brassicae*). Changes in the inorganic constituents during pupation (*Pieris brassicae*). LEONORE BRECHER. *Biochem. Z.* 211, 40-64(1929).—The blood from pupae of *Sphynx pinastri* contains so little Na that it cannot be detd. by methods developed for human blood. On the av. the content per 100 cc. is as follows: K 137.8 mg.; Ca 33 mg.; Mg 56 mg.; Cl 59.5 mg.; total P 207 mg. and inorg. P 66 mg. No differences were observed in the compn. of the blood from male and female pupae. The total base equiv. is 0.096 while that of the acid is 0.046, so that the excess of 0.050 base equivs. are assumed to be in combination with org. acids. In studying the blood compn. at different stages of pupation there is a rise in K and a loss of Ca at successive stages. The Mg content is much greater in pupae still feeding than in the fixed pupae. S. M.

12—FOODS

F. C. BLANCK AND H. A. LEPPER

Vitamins in canned foods. VIII. Home canning and commercial canning contrasted in their effect on vitamin values of pears. MARTHA M. KRAMER, WALTER H. EDDY AND E. F. KOHMAN. *Ind. Eng. Chem.* 21, 859-61(1929); cf. *C. A.* 18, 715; 19, 543, 683; 20, 617; 23, 2743. Kieffer pears, when still hard and green, were commercially canned with no apparent loss of vitamin C, provided the O was removed by suitable procedure. Even when no particular pains was taken to remove O, beyond that practiced in com. canning, the loss of vitamin C was not great. In home-canned pears, the vitamin C was almost completely destroyed by the open-kettle method and largely by the cold pack method. Kieffer pears allowed to ripen and mellow previous to canning resulted in a commercially canned product in which vitamin C was appreciably lower. The vitamin C content of the canned Bartlett pears was approx. that of the canned ripened Kieffer pears. Bartlett pears, raw or canned, are relatively low in vitamins A and B. J. A. KENNEDY

A report on the possibilities of poisoning from cadmium plate. GEORGE P. DUBERNELL. *Metal Ind. (N. Y.)* 27, 372(1929).—The use of Cd in contact with foods should be avoided. Cd in soln. is a powerful emetic. It may be used in specific cases where conditions are definitely known and do not vary, where the foodstuffs are neutral or alk., and will not turn acid. Acid food products may attack Cd plate readily and cause illness to persons eating the products. The difference between Zn and Cd salts as poisons is one of degree only, in which Cd salts are stronger in action. W. H. BOYNTON

Studies in cereal chemistry. V. The conditioning of wheat. T. H. FAIRBROTHER. *Ind. Chemist* 5, 281-5(1929), cf. *C. A.* 23, 4278. In conditioning wheat, the H₂O content is adjusted so that the bran is toughened and the endosperm is left dry and friable. This gives broad bran flakes and a white flour free from bran particles. A detn. of the distribution of H₂O in the wheat berry is therefore as important as total H₂O content. Although the phys. changes in tempered wheat have usually been regarded the most important, the chem. changes due to enzyme activity are significant. Proteolysis is detrimental to most wheat except a few varieties that are

gluten bound. An increase in diastatic activity is advantageous to many flours, and probably occurs during the conditioning process. If heat is used in conditioning, hot-air currents are preferable to radiators. **VI. Enzyme activity in flour and wheat.** *Ibid* 313-6.—The enzymes important in bread making are *cytase*, *diastase* and *protease* of flour and *zymase* of yeast. The diastatic power of flour is directly related to baking strength, provided the gluten is the same. An excessive use of malt ext. as a source of diastase impairs the color and texture of the crumb. In detg. diastatic activity the temp and p_H must be controlled. Proteolysis reduces the hydration capacity of the gluten, a process probably correlated with the gliadin-glutenin ratio. Minor enzymes in flour include an oxidase which gives a brown color to bread, and *catalase*, the detn. of which has been suggested as an index of flour grade. Several methods of detg. diastatic and proteolytic activity of flour are reviewed. **AMY LEVESCONTE**

A new method for the rapid estimation of moisture in wheat. E. F. BURTON AND ARNOLD PITT. *Can. J. Research* 1, 155-62(1929).—Methods for estg. moisture in wheat are discussed and a new one is described which is very rapid. A container which holds some of the wheat is introduced into the rapidly alternating field of a specially arranged radio circuit; a change in the strength of the current is measured by an ammeter. The ammeter may be calibrated to read the moisture content directly. The app. is strong and portable; accessories are replaceable and are relatively inexpensive; no heating or weighing of the sample of wheat is necessary; and the reading on the ammeter is instantaneous. **G. H. W. LUCAS**

A comparison of the copper content of Oklahoma wheat with those of other states. JAMES E. WEBSTER AND FRANK JANSMA. *Science* 70, 174(1929). The Cu content of wheat from different parts of the U. S. detd. by the tentative method of A. O. A. C., varied from 4.2 to 8.7 mg. per kg. of fresh wheat or 239 to 497 mg. per kg. of ash. There was no great abundance or lack of Cu in any section, although the percentage in the Northern states was usually lower. There was no relation between Cu content and ash content. **AMY LEVESCONTE**

Studies on the resistance of wheat starch to diastatic action. J. G. MALLOCH. *Can. J. Research* 1, 111-47(1929). cf. *C. A.* 23, 3754. The resistance of starch to hydrolysis and the concn. and activity of the enzyme present are the independent variable factors that control the diastatic activity of wheat flour. Measurement of starch resistance involves the inactivation of the natural diastase with Na tungstate, washing out the excess precipitant and the addn. of a fixed amt. of *taka-diastase*. The resistance of the starch is lowered by grinding or extn. with ether. The conditions under which the wheat is grown affect diastatic activity in sprouted wheat because of some change in quantity or nature of the enzyme. Modifications of Rumsey's method for diastatic activity are indicated. 90 references are given. **G. H. W. LUCAS**

Studies on heated wheat flour. LAJOS PAP. *Magyar Chem. Folyóirat* 35, 106-11, 119-22(1929).—A study was made of the Kent Jones method of heat treating flour in its application to Hungarian flours. The temp. and heating time recommended by K.-J. are too high for Hungarian flours, they lessen the baking capacity. Absolute moisture content is not important, only the excess moisture above water content in air-dry state. The heating of flours is valuable in case of imperfect ripening caused by a wet season. This condition is seldom found in Hungary. **S. S. DEE**

The proof of bleaching in flour. JOS. KULMAN. *Chem. Listy* 23, 375-82(1929).—A benzene ext. of flour shows a concn. of 0.002% coloring matter with variations ranging $\pm 0.0002\%$. Freshly ground flour never shows a concn. below 0.0018%; values below 0.0018% indicate an old or bleached flour. Unbleached flour does not fall below this level even after 7 months of storage; fresh bleached flour falls below this level within the first month of storage. The coloring matter is considered to be carotins. A benzene ext. of unbleached flour whether freshly ground or naturally aged remains unchanged while being evapd. at 110-115° (or digested for 30 min.); i. e., the green gray shade remains in its original shade. Benzene exts. of flours bleached with Cl or NO_2 darken to a red-brown color during evapn. After making up the soln. to the original vol. with benzene, the soln. of the unbleached flour remained a yellow-green, i. e., unchanged, while the soln. of the bleached flour was a red brown, i. e., different from the original coloration. By using ultra-violet rays from a C arc, spectrograms were taken of the benzene exts. The above are yielded lines which were dense and simulated a continuous spectrum and ranged up to 230 μ . Gasoline and $CHCl_3$ show no absorption up to 250 μ , while C_6H_6 absorbs ultra violet light strongly. The absorption spectrum of a flour 3 yrs. old and a chlorinated flour showed no difference. A series of flours fresh, bleached and of various ages up to 3 yrs. showed the same absorption spectra. Bleaching and natural aging cause a decrease in the yellow coloring

matter and the slight traces of carotin in very old flours is enough to give an absorption spectrum which is identical with that of a benzene ext. The absorption bands correspond to those of pure carotin: 488–470 μ and 456–438 μ . In CHCl_3 the absorption spectrum shifted further to the ultra-violet but showed no characterizations. K. assumes a destruction of the carotins by oxidizing agents as Cl or NO_2 during bleaching or by atm. O during storage. Naturally and artificially aged flours showed no differences in their absorption spectra. The exts. in gasoline show the same absorption spectra with small differences in the width of the band. K. thinks that this is due to a series of decompn. products to which Cl or NO_2 becomes attached. The solvents gasoline, C_6H_6 , $\text{CH}_3\text{C}_6\text{H}_5$ and xylene remain colorless when digested at 110–115°; when Cl or NO_2 is passed through the solvent prior to the digestion, the solvent becomes colored just as in the cases above where the flour was bleached with Cl or NO_2 . K. thinks that the Cl or NO_2 which was bound by the unsatd. products during bleaching is liberated in the solvent with the formation of a red-brown color with hydrocarbons of the C_6H_6 series (toluene), and with unsatd. fatty acid series boiling above 100°. A test was made on a series of 15 flours with satisfactory results. Old flours gave the same reaction as bleached flours, and the 2 were not distinguished.

FRANK MARESH

Detection of the chemical treatment of flour. J. HOREL. *Chem. Obzor* 4, 196–7 (197 English) (1929).—The sensitivity of the reaction with KI for the detection of small quantities of K persulfate or Novadelox (0.005 g. in 100 g. flour) is greatly increased by heating the soln. The following method is also found very satisfactory: 2 solns. of benzidine in alc. are prepd. which consist of 3 g. in 100 cc. of 96% alc. and 0.5 g. in 100 cc. alc., diluted with water (1:1) for the detection of Novadelox and K persulfate, resp. A thin and carefully smoothed layer of flour to be tested (similar to Tekár's test) is spread on the glass and a hot soln. of benzidine poured over. If the flour has been treated with persulfate, numerous black, sharp and round specks appear at once. In the presence of Novadelox a few, round, brownish green specks can be observed which become more distinct and spread into stains. The whole sample turns pink after 10 min.

JAROSLAV KUČERA

A survey of present methods of grading milk at condenseries, evaporated and dry milk plants. P. A. DOWNS, G. C. SUPPLEE AND M. J. PRUCHA. *J. Dairy Sci.* 12, 374–6 (1929).

E. J. C.

A new investigation concerning the low-temperature pasteurization of milk and a reaction for controlling the pasteurizing temperature. SIGURD ORLA-JENSEN. *Proc. 8th World's Dairy Congress 1928*, 107–23, cf. C. A. 23, 1441—Pasteurizing 5 min. at 68° gives practically the same results as the "holder" process (30 min. at 63°), both from a bacteriological and from a chem. standpoint. The test is suggested to distinguish milk pasteurized at low temp. from that pasteurized at high by the ratio (A) between the cream line in the undild. milk and in the milk dild. with an equal vol. of water after 2 hrs. at about 12–15°. Raw milks of commerce are frequently as slow to show a cream line as milk which had been subjected to fairly drastic heating; but a preliminary heating (before testing) of 5 min. to 50° only increases A for raw milk and rather tends to decrease it for low-temp. pasteurized milk. The temp. at which A begins to fall from over unity to under unity is 62° for 30 min., so that this reaction gives a far better indication of the appropriate low-temp. pasteurization temp. than Storch's reaction used to give on the high-temp. pasteurization temp. If milk is heated to over 95°, mixed with about $\frac{1}{2}$ vol. of raw milk and the mixt. dild. with an equal vol. of water, there will be no cream sepn. because the coagulated albumin has gone into solution in the form of albuminate. The changes operative in destroying the cream line on heating milk do not occur in the membrane of the fat globules but in the milk plasma; the membrane of the fat globules cannot consist of heat-coagulable proteins (e. g., globulin), but it may very well be a mucin (Storch, 1896) or more likely casein or similar protein (Titus, Sommer and Hart, C. A. 22, 979). The phenomenon in question is attributed to the presence in the milk plasma of an agglutinin which affects the membranes of the fat globules and which is destroyed on heating the milk; it does not cause any attraction between the globules, but only enables them to stick together when they chance to meet. Cream rising in milk depends also on another thermolabile factor, besides the agglutinin, nothing concerning this factor is yet known, except that it is to be found in whey, but is not salted out from whey together with either the globulin or the albumin.

A. PAPINEAU-COUTURE

Studies in the holding method of pasteurization. G. DALLA TORRE. *Proc. 8th World's Dairy Congress 1928*, 134–5. In the preliminary treatment of the raw milk for the removal of dirt, clarification by means of centrifugal force induces a higher bacterial count than filtration. In 7 expts. the bactericidal effects of heat (which

begins with the preheater and ends when the pasteurized milk leaves the holder) was always more than 99.9%. A certain amt. of recontamination always took place when the freshly pasteurized milk was passed over the refrigerator. No appreciable increase was established during conservation, at either a high or a low temp., of the spore-bearing aerobes and anaerobes which attack proteins, or of the butyric acid ferments. Regarding the odor and flavor of the pasteurized milk kept at high temp., there was nothing unusual except the increased acidity which is normally observed when the milk approaches the souring pt. Old pasteurized milk kept at low temps. showed a very slight increase in acidity and frequently an abnormal odor, resembling that of cooked cauliflower.

A. PAPINEAU-COUTURE

The pasteurization of milk in the production of some types of Italian cheese. GIUSEPPE FASCETTI. *Proc. 8th World's Dairy Congress 1928*, 135-6. —Caciocavallo cheeses made from pasteurized milk were regular in type; they had a drier body and from this pt. of view were not so good as caciocavallo cheese made from raw milk. The flavor was uniformly good but slightly more piquant than normal. Montasio cheese made from pasteurized milk ripens more quickly than raw-milk cheese of the same kind, but has a slightly inferior flavor and texture. In the case of grana reggiano cheese pasteurization of the milk produces a cheese of perfect body and texture and of superior color; ripening is somewhat slower but the flavor is uniformly good.

A. PAPINEAU-COUTURE

Reductase test. G. B. REED AND A. L. McNABB. *Can. Pub. Health J.* 20, 413-5 (1929). —Milk samples were exam'd in parallel by agar count, direct microscopic count and methylene blue reductase test. The reductase test offers advantages in making rapid tests of samples having high bacterial counts. The direct microscopic count is subject to wide variations. Further tests should be made to establish the quant. value of the reductase test.

R. E. THOMPSON

Detection of the skimming of milk. E. ROUSSEAU. *Ann. fals.* 22, 405-6 (1929) — In the detection of skimming of milk by comparative analysis of the suspected sample and a sample of authentic milk obtained from a milking of the same cows the chemist may be deceived if the milking is incomplete, as the last portions of the milk drawn from the udder are richer than the first portions.

A. PAPINEAU-COUTURE

A serodensimetric constant (C. S. D.) for the detection of watering of milk. F. OLIVARI. *Ann. chim. applicata* 19, 214-34 (1924). There is a relation between density ρ and the chloride content C of milk serum $C + 3.85 C^2 = K$ (Porcher). K is the serodensimetric const. (C. S. D.) and is much more useful than serum d. in detecting watering of milk as it shows a greater variation on diln; e. g., two solns. with sp. gr. = 1.0263 and 1.0297 show $K = 32$ and 35.5.

A. W. CONTIERI

Determination of fat in milk and cream by the method of Høyberg. KR. STØREN AND HANS DØVLE. *Melding. e. Norges Landbruks* 8, 26-44 (1928). The methods of Høyberg and Gerber are compared. Especially is exam'd the applicability of Høyberg's method in cases where Gerber's method is excluded. For common mixed milk the 2 methods are equally accurate. In the detn. of fat in individual milk the method of Høyberg gives good results when the butyrometer is given an extra turn and put in the water bath. In exam'n of milk from one cow the method of Roesch-Gottlieb sometimes fails, and the method of Schmid Bondzynski-Ratzlaff should be used for control.

ARNE DRØGSETH

Practical application of corrosion tests: resistance of nickel and Monel metal to corrosion by milk. ROBERT J. MCKAY, O. B. J. FRASER AND H. E. SEARLE. *Am. Inst. Mining Met. Eng., Tech. Publ. No.* 192, 47 pp (1929). —I. Lab. and field tests were conducted to det. the corrodibility of Ni and Monel metal in milk. In the lab. tests the max. amt. of Ni dissolved in milk and buttermilk was 12 p. p. m. and Monel metal was less sol. Agitation raised the soly. at pasteurizing temps. but not at room temp. The soly. in buttermilk increased with aeration at low temps. and in both sweet and buttermilk at elevated temps. Temp. changes at storage and room temps. did not increase the soly. appreciably but at high temps. the soly. was considerably greater. Acidity affected the soly. of Ni depending upon aeration and agitation. Winter milk was more corrosive than summer milk at low temps. The soly. in lactic acid was greater than in milk of equiv. acidity. Introduction of egg albumin (except with Ni), casein, butterfat and lactose tended to decrease the soly. of both Ni and the alloy. II. Tests of Ni and Monel metal were conducted on preheaters, holding tanks and cooling coils of a pasteurizing plant. A ppt. of casein on the preheating coils formed a protective film which inhibited corrosion. On surface coolers the metals were corroded with the formation of brown protein stains. Corrosion rates in the holding tanks increased with temp. The Ni dissolved to the extent of 1.3 p. p. m. In milk

condensers the max. corrosion was found in the vapor spaces of vacuum pans. Tests in buttermilk machines showed no greater corrosion than the coils used on sweet milk. This is attributed to the lack of air in buttermilk machines. Small quantities of Ni did not impart bad flavors to milk.

Reconstituted or artificial cream. L. J. LORD. *Food Manuf.* **4**, 260, 265(1929).
B. E. ROETHELI
J. A. KENNEDY

The presence of mixed glycerides in butter. F. DE'CONNO AND E. SCOPINARO. *Ind. olii min. e grassi* **9**, 57-9(1929); cf. *C. A.* **23**, 3756.—The isolated fat, free from impurities, reached 83-84%, having d_{40}^{20} 0.866, m. 30-2°, solidifying point 20-22°, m. p. of insol. fatty acids 39-41°, solidification point 34-36°, acid no. 1.36, sapon. no. 228.5, I no. 32.7; volatile acid no. 27.36. 168 g. in 168 cc. of acetone and 84 cc. of chloroform, when left overnight, formed 16.55 g. of a cryst. product that on recrystn. from acetone m. 51°, sapon. no. 215, I no. 0.71, volatile acid no. 1.36, C 75.45%, H 12.05%, O 12.50%, indicating a mixed glyceride corresponding to myristodipalmitin. The presence of mixed glycerides was shown by the total acids having m. p. 49° and satn. no. 226. This coincided with a mixt. of myristic-palmitic acid, and was confirmed by sapon. with alc. KOH, bringing in soln. with H₂O the K soaps, evapg. the alc., pptg. with MgCl₂ sepg. Mg salts on a filter, washing with H₂O, drying, extg. with hot alc. for 1/2 hr., and filtering rapidly the warm alc. soln. to sep. the insol. part. The alc. filtrate sepd. on cooling crystd. Mg myristate. Mg palmitate was present in the insol. part. The fatty acids from the Mg soap insol. in alc. m. 61°, satn. no. 219.5; while those of the soap sol. in alc. m. 54°, satn. no. 245.52. The acetone-chloroform soln. from which the myristodipalmitin had been sepd., when cooled to -15°, deposited another solid product, that sepd. on a filter, dried and weighed reached 6.62 g. Recrystd. from ether the sapon. no. of this was 201.94, I no. 1.02, sol. volatile fatty acids no. 1.44, C 76.25%, H 12.23%, O 11.52% 14% of the solid mixed glycerides was isolated from the fat, leaving an oily, stable, slightly yellow liquid with sapon. no. 234.32, I no. 38.37, volatile acids no. 38.99.

Oleomargarine. GILBERT F. POUCHON. *La Nature* **2813**, 62-8(1929).—The history, properties and manuf. of this product are discussed. P. THOMASSET

The use of tin foil in packing cheese. Rindless cheese. ELTEN. *Chem.-Ztg.* **53**, 586(1929).—Tin foil used for packing cheese contains 96-98% Sn, and small quantities of Sb, Pb, Cu, etc. The latter metals cause the dark deposits on cheese. It was found that poor grades of cheese are ground up, mixed with an acid (e. g., citric), wrapped in foil and sold as high-grade cheese. W. C. EBAUGH

The analysis of egg-bearing pastes. MARIO SETTIMI. *Ann chim. applicata* **19**, 182-8(1929).—For albumin, the best method is the Esbach reaction as proposed by Leone (*C. A.* **19**, 2339). For the yolk, the lecithin is detd. by extn. with abs. EtOH, and pptg. with CdCl₂; cholesterol, by extn. with CHCl₃, saponifying, dissolving again in CHCl₃ and adding H₂SO₄ (concd.), which gives a purple-red coloration. The lipochromes are detected by their not being decolorized by such reducing solns. as Zn-NaOH, Zn KOH or SnCl₂, HCl.

Modern equipment in the bakery and confectionery trades. J. VALENTINE BACKES. *Food Manuf.* **4**, 261-4(1929).—A discussion with photographs of new machinery.

Emulsification in the confectionery and bakery industries. EDMUND B. BENNION. *Food Manuf.* **4**, 247-9(1929).—A discussion of some colloidal problems. J. A. K.

The preservation of citrus fruit juices. V. R. KOKATNUR. *Fruit Products J. and Am. Vinegar Ind.* **9**, No. 1, 16-17, 22(1929).—K. makes use of an ext. of the peel for preserving the juice. The process is patented. J. A. KENNEDY

Sugar-acid ratio of oranges. D. J. ESSELEN. *Farming in South Africa* **4**, 87-8(1929).—A definite increase in the sugar acid ratios of seedling and Valencia oranges was obtained by wilting the fruit for 4 weeks at atm. temp. fruit from "sweet" trees showing the greatest rate of increase in ratio. In seedling fruit, the percentages of sugar increased while the acid content decreased during wilting, but in Valencia oranges the sugar content tended to decrease instead of increase. In general, wilting for 4 weeks resulted in a greater increase in the sugar acid ratio of Valencia oranges than of seedling oranges, both varieties losing about 25% in wt. during this period. It seems doubtful that it will prove economical to attempt to improve the quality of sour oranges by wilting prior to shipment. K. D. JACOB

Chemical injury to watermelons in transit. W. W. GILBERT AND F. C. MEIER. *U. S. Dept. Agr., Circ.* **74**, 1-9(1929).—See *C. A.* **22**, 3240. W. H. ROSS

Preservation of mangoes by cold storage. C. S. RAMAYYAR AND N. V. JOSHI. *Agr. J. India* **24**, 124-6(1929).—Fully ripe mangoes could be kept for 3 weeks without

rotting, while partially ripened ones could be kept for about 6 weeks, by storing them at 10°. When stored at 10°, green mangoes usually ripen unevenly, the ripening enzymes apparently becoming inactive after about 3 weeks. K. D. JACOB

Analysis of coffees adulterated with chick-peas. J. FRÉZOULS. *Ann. fals.* **22**, 415-20(1929).—Detection of chick peas in coffee (practically the only form of adulteration practiced in Tunis) can be effected by the I-starch test and by microscopical examn. after decolorizing with dil. NaOH and alk. hypochlorite. Detn. cannot be carried out by detn. of starch by acid inversion, because coffee contains reducing matter, while diastase inversion is long and does not completely remove the reducing matter of coffee. The following polarimetric method has been devised: ext. 3 g. (ground to pass an 80-mesh sieve) with 50-60 cc. Et₂O in a centrifuge tube, centrifuge, decant, heat to remove the last traces of Et₂O, transfer to a beaker, add 10 cc. NaOCl soln. (12 chlorometric degrees) and 20 cc. concd. HCl, let stand 20 min. with frequent stirring, if necessary add more NaOCl for complete decoloration, transfer to a 100-cc. volumetric flask with dil. HCl (2 HCl to 1 H₂O), add 2 cc. of 4% phosphotungstic acid drop by drop with stirring, make to 100 cc., and polarize in a 2-dm. tube. Under these conditions coffee gives no rotation. A no. of samples of roasted chick peas gave: α 21.5-26.0° (saccharimetric) (av. 23.65°), starch 40.1-44.9% (av. 44.25%), H₂O 6.2-14.2% (av. 9.5%), α on dry basis 23.9-27.7° (av. 26.5°), starch on dry basis 44.8-51.95% (av. 49.70%). Working on known mixts., the amt. of peas found was well within 5% of that actually present. A. PAPINEAU-COUTURE

Monosodium glutamate as a chemical condiment. JOHN E. S. HAN. *Ind. Eng. Chem.* **21**, 984-7(1929).—This salt is just perceptible to taste (meat-like) when 1 part is dissolved in 3000 parts of H₂O. This flavoring power is 15 times as strong as that of sugar and seven times as strong as that of NaCl. The meat-like taste has its highest efficiency in the absence of NaCl and vinegar. The salt is marketed under the trade name, *Ajinomoto*. Statistical data are given as well as its uses as a condiment. There is an unusually large demand for this condiment by vegetarians and care must be taken that the protein used for manuf. does not originate from meat. H discusses patents and com. production both by the Japanese and Chinese. The chief problems confronting the Chinese manufacturers lie in the shortage of raw materials. J. A. KENNEDY

Iodized salt. WILLIAM C. GEAGLEY. *Am. J. Pub. Health* **19**, 991-6(1929).—A method is recommended for mixing the iodide with Ca phosphate and finally with the dried salt. *Detn. of I₂ in iodized salt*—Dissolve a 5 g. sample in 25 cc. of H₂O in a separatory funnel. Prepare at the same time 2 standards using 4.5 cc. and 5.5 cc. of the standard iodide soln. (0.2214 g. KI in 1 l. of distd. H₂O; 5 cc. of this soln. is equiv. to 5 g. of iodized salt contg. 0.0221% KI). From this point proceed with both sample and standards as follows: Add 5 cc. of phosphoric acid (U. S. P.). Pipet exactly 10 cc. of CS₂ (c. p.; water-clear; if not redistil) into the mixts. Add 20 cc. of H₂O₂ (U. S. P.) and rotate each for 5 mins. Draw off portions of the lower CS₂ layer through a pledget of absorbent cotton into test tubes of equal diam., $\frac{3}{8}$ or $\frac{1}{2}$ in. preferably. Stopper tubes securely and compare the color of sample with that of controls. The sample should fall within the range of the 2 controls (10% variation of I₂ content). This method may be used as an accurate, quant. lab. procedure by the use of a Duboscq colorimeter, in which case one control made with 5 cc. of the standard iodide soln. is used for comparison. A number of representative samples of the different brands offered for sale in the regular trade channels were collected and their I₂ content detd. A deficiency was noted in every instance except two. J. A. KENNEDY

Agricultural research in Scotland in 1928. ANON. *Trans. Highland and Agr. Soc. Scotland* [5], **41**, 178-95(1929).—Results of researches on the *Mineral metabolism of animals, colors and odors in cheese, prepn. of cheese from milk pasteurized at high temps., weak coagulation of cheese curd, and soils* are briefly summarized. K. D. JACOB

The relation of the chemical composition of pasture to its feeding value. J. B. ORR. *Trans. Highland and Agr. Soc. Scotland* [5], **41**, 99-114(1929).—A summary of the results of investigations on the chem. compn. of pastures, the effect of deficiencies in pastures on the rate of production and health of animals grazing on them, and means for remedying deficiencies in the chem. compn. of pastures. K. D. JACOB

Calorific value of soluble carbohydrates in feeding stuffs. L. A. ALLEN. *J. Agr. Sci.* **18**, 691-701(1928).—Investigations were conducted to arrive at a value for the heat of combustion of acid- and alkali-sol. carbohydrates in feeding stuffs, without isolating the constituents. The content of fat or oil, protein and ash were detd. by the usual methods. The fiber content was estd. by boiling the dried whole meal successively with 1.25% H₂SO₄ and 1.25% KOH for 30 min. The remainder of the dried

whole meal was assumed to be carbohydrate. The heats of combustion of the whole meal, fat-free meal and fiber were detd. in a bomb calorimeter; that of the protein was calcd. from known data. From these results the calorific value of the sol. carbohydrates was calcd. These values varied from 3284 to 4864 cal. per g. in the cases of groundnut cake and straw, resp. The results indicate that the calorific values of the carbohydrates in different feeding stuffs are very variable quantities, and are also considerably higher than the values usually assigned to the simpler carbohydrates of known constitution. It has been shown that the heats of combustion of these simpler carbohydrates generally increase with increasing mol. complexity; and it has also been shown that crude fiber is a mixt. of variable compn. of more complex carbohydrate and lignin substances, some of which are more or less dissolved by acid and alkali. Hence it would appear that, in estg. the carbohydrate content and the calorific value by the method adopted, these more complex compds. must enter into consideration. The presence of complex carbohydrates which are either wholly or partially hydrolyzed by dil. acid and alkali may also explain the variation in the heats of combustion as estd.

P. R. DAWSON

The proximate chemical analysis of Philippine foods and feeding stuffs. II. F. T. ADRIANO, MAMERTA MANAHAN AND FRANCISCO BARROS. *Philippine Agr.* 18, 119-25(1929); cf. C. A. 19, 3129.—A tabulation of analyses of 229 samples of foods and feeds arranged by classes. These samples constituted the routine work of the Dept. of Agr. Chemistry of the Univ. of the Philippines from 1925 to 1928.

A. L. MEHRING

A short note on the nutritive value of linseed cake. JAMES STEWART. *J. Agr. Sci.* 18, 702 3(1928).—Data obtained from a single lamb, living under conditions very suitable for getting accurate data, indicate a starch equiv. of 72.78 lb. per 100 lb. of linseed cake. This agrees well with Kellner's figure of 72 lb. per 100 lb. of linseed cake of 88% dry matter.

P. R. DAWSON

The feeding of dairy cows. JAMES MACKINTOSH. *Proc. 8th World's Dairy Congress 1928*, 19 25.—A discussion of the principles governing the selection of rations for winter feeding and summer feeding of milch cows.

A. PAPINEAU-COUTURE

The importance of salt in the feeding of dairy cows. E. MARRE. *Proc. 8th World's Dairy Congress 1928*, 59-69.—A no. of cases are cited where milk production was very appreciably increased by judicious addn. of salt to the rations of cows. By gathering in hay before it is completely dry (about $\frac{3}{4}$ dry) and adding about 2-4% salt, an adequate dose of salt in the ration is ensured, the quality of the fodder is improved and there is little or no loss of food value as compared with the green hay, while complete drying in the sun as at present carried out produces losses up to 30% of the food value of the green hay.

A. PAPINEAU-COUTURE

The importance of minerals to swine. G. H. CONN. *Feedstuffs* 1, No. 10, 10-11 (1929).

K. D. JACOB

Analyses of *Leucaena glauca*, *Hibiscus esculentus*, *Moringa pterygosperma* and king yams (JOACHIM) 11D. Some of the effects produced on the richness of cow milk by feeding cod-liver oil (GOLDING) 11E. Refining linseed oil for edible purposes (DIETERLE) 27. Analyses of feeding stuffs, silages and milks during 1928 (TOCHER) 15. Detection of annatto in fats (GUARNIERI) 27. Studies in milk secretion based on the variations and yields of milk and butter fat produced at morning and evening milkings (BARRLETT) 11F. Low-temperature pasteurization (ZELLER, *et al.*) 14. Apparatus for mixing grain, etc. (U. S. pat. 1,728,411) 1.

BARATON, P.: *L'emmagasiner et la conservation des grains et des farines*. Paris: Charles-Lavauzelle & Cie. 140 pp. F. 7.50. Reviewed in *Chimie & industrie* 22, 217; *Ann. fals.* 22, 433(1929).

MEYSAHN, W., AND MEYSAHN, E.: *Rationelle Milchviehhaltung*. Hildesheim: Verlag der Molkerei-Zeitung. 208 pp. Reviewed in *Chimie & industrie* 22, 444(1929).

PORCHER, CH.: *Le lait au point de vue colloidal*. Lyons: Le Lait. 530 pp. Reviewed in *Chimie & industrie* 22, 226-7(1929).

Sterilizing foods, vaccines or other materials. DAVID CROWTHER. U. S. 1,728,333, Sept. 17. The material is treated with a gas such as CO₂ which is relatively inert to it, under pressure and for a sufficient time to effect satn. of microorganisms with the gas and the pressure is then suddenly released to cause disruption of the organisms. U. S. 1,728,334 describes an app. for the same purpose.

Treating grain, flour, etc. N.-V. ELECTROCHEMISCHE INDUSTRIE. Brit. 307,428, March 7, 1928. Grain, flour, meal, etc., are treated with a current of air which has been activated by passing it through a soln. of a persulfate or of monoperoacid salts to which Cl ions may be added (suitably by use of NH_4Cl) and which may be acidified. K persulfate and H_2SO_4 may be used in prepg. the soln. Flour thus treated may also be treated with peroxides, persulfates, bromates, etc. Cf. C. A. 23, 3994.

Milling flour containing the whole grain. ELIJAH M. KINSLOW (to Vitamin Milling Corp). U. S. 1,728,184, Sept. 17. An arrangement of app. and details of milling procedure are described.

Improving the baking quality of flour. ERNEST A. FISHER and CHARLES R. JONES. U. S. 1,727,429, Sept. 10. Flour, in cloud form, is subjected to treatment by a strong current of air of such temp. and humidity that the temp. of the flour is raised to about $55-80^\circ$ without substantial loss of moisture. An app. is described.

Dough and yeast preparation for bread making. JOHN R. WHITE. U. S. 1,729,409, Sept. 24. Mucic acid is used with yeast in prepg. dough and may be used as an ingredient of the last of a series of liquids in which yeast is propagated.

Gluten-washing apparatus. EDWARD J. SISSER. U. S. 1,728,374, Sept. 17. Structural features.

Apparatus for pasteurizing milk, honey, etc. DEDRICK A. MAANUM and ALFRED J. DAVIS. U. S. 1,728,424, Sept. 17. Structural features.

Preserving butter, margarine, etc. J. E. NYROP. Brit. 307,167, Jan. 26, 1928. The process described in Brit. 297,256 (C. A. 23, 2510) is applied to butter, margarine and similar water-in-oil or oil-in-water emulsions having a small content of casein or other protective substance. Paste-like products are formed which may be kneaded with water to cause absorption of the water and reproduce a substance of butter-like character.

Meat-curing compound. ALEXANDER MURDOCH. Can. 292,110, Aug. 13, 1929. A compn. comprises a mixt. of water, saltpeter, coarse salt and pure malt ext.

Colored meal for use in sausage or other foods. ALFRED O. MORRIS. U. S. 1,729,590, Sept. 24. An aniline dye soln. (suitable for use in foods) or other suitable tinted liquid is sprayed on to starch to color it evenly, moisture is driven off, the material is sieved and the product is mixed with flour.

Grading fresh or dried fruits by flotation. ERNEST H. WIEGAND and DELOSS E. BULLIS (to the citizens of the U. S.). U. S. 1,728,583, Sept. 17. A bath such as a salt or sugar soln. is used having a sp. gr. between those of the juice of the mature and of the immature fruit; the most mature fruit sinks and the immature fruit floats.

Drying tea. J. P. CHALIHA. Brit. 307,591, Feb. 6, 1928. Tea is "fired" or dried preparatory to withering in a chamber under reduced pressure (suitably at about 90° under 15 in. Hg pressure or at about 100° under 23.5 in. Hg pressure). An app. is described.

13—GENERAL INDUSTRIAL CHEMISTRY

HARLAN S. MINER

Technical physics in chemical industry. PAUL GMELIN. *Z. tech. Physik* 10, 241-5 (1929). Knowledge of materials and technical physics. G. MASING. *Ibid* 245-8. Technical physics in the iron industry. F. KÖRBER. *Ibid* 248-51. The significance of technical physics for the glass industry. EBERHARD ZSCHIMMER. *Ibid* 253-6. These papers are accompanied by a no. of others of general interest in the field of tech. physics.

B. J. C. VAN DER HOEVEN.
Development of inorganic chemical industry in the territory of the Czechoslovakian Republic. JAROSLAV MILBAUER. *Chem. Obzor* 4, 220-6 (1929).—An account is given of the origin and development of inorg. chem. industry in the present territory of Czechoslovakia since the year 1407 up to present time.

JAROSLAV KUČERA.
Marketing American chemicals. Merchandizing methods that have advanced a relatively new industry to a dominant position in the domestic and world markets. C. C. CONCANNON. *J. Chem. Education* 6, 1630-7 (1929); cf. C. A. 23, 4980.—An address.

E. J. C.
What the chemical engineer demands of construction materials. W. R. HUEY. *Chem. Met. Eng.* 36, 522-5 (1929). Selecting metals for high-temperature-pressure requirements. S. D. KIRKPATRICK. *Ibid* 526-7. What chrome-nickel steels offer to chemical engineers. JOHN A. MATHEWS. *Ibid* 528-9. How chrome steels serve the

nitrocellulose manufacturer. THOS. MCKNIGHT. *Ibid* 530-1. Chromium irons and steels exhibit widely varying properties. WALTER M. MITCHELL. *Ibid* 532-4. High-chromium cast steel flue becomes severely brittle. J. D. DAVIS. *Ibid* 534. Cheaper low alloy steels for numerous applications. JEROME STRAUSS. *Ibid* 535-6. Weak sulfuric acid yields to nickel-silicon steels. W. B. EARNSHAW. *Ibid* 536. Stainless mirror used in photography of explosion waves. G. ST. J. PERROTT. *Ibid* 536. Low-cost corrosion resistance with alloyed cast iron. J. S. VANICK. *Ibid* 537-9. Inhibitors as a means of reducing corrosion. E. L. CHAPPELL. *Ibid* 539. Early obsolescence may dictate common iron and steel. E. L. CHAPPELL. *Ibid* 540-1. Where high-silicon irons serve chemical industry. ANON. *Ibid* 541-2. New alloys withstand hydrochloric acid. BURNHAM E. FIELD. *Ibid* 542. Varied application characterizes aluminum in industry. PAUL V. FARAGHER. *Ibid* 543-5. Nickel and nickel alloys offer diverse corrosion resistance. R. J. MCKAY. *Ibid* 546-8. How chemical industry applies copper and copper alloys. WM. H. BASSETT. *Ibid* 549-51. Tantalum. A metal for difficult corrosion problems. CHESTER H. JONES. *Ibid* 551. Unfamiliar uses increase tin applications. CHARLES L. MANTELL. *Ibid* 552. Silver. A metal of specialized use in chemical plants. ANON. *Ibid* 553. Tantalum proves economical for calorimeter body. G. C. MAIER. *Ibid* 553. Precious metals for ultimate corrosion resistance. FREDERIC E. CARTER. *Ibid* 553-5. Chamber acid depends upon lead. GEO. O. HIERS. *Ibid* 555-6. Zinc and its alloys resist atmospheric corrosion. WM. H. FINKELDEY. *Ibid* 556-7. Electrodeposited films for resistant surfaces. COLIN G. FINK. *Ibid* 557-8. Stellite for resistance to erosion and abrasion. W. A. WISSLER. *Ibid* 558. Where chemical engineers use hard rubber in the plant. D. E. JONES. *Ibid* 559-60. Soft rubber. Versatile lining for process and storage equipment. N. GIBSON MADGE. *Ibid* 560-1. New importance attaches to glassware as construction material. A. E. MARSHALL. *Ibid* 561. Wide variety of ceramic materials find industrial application. GEO. H. BROWN. *Ibid* 562-3. Special treatments increase resistance of Portland cement concrete. S. R. MITCHELL. *Ibid* 564-5. Chemical brick and cement afford long-time protection. A. M. WEBB. *Ibid* 565-6. New construction possibilities in glass-enameled tubing. S. J. CROOKER. *Ibid* 566. Resistant woods satisfy most corrosion requirements. ANON. *Ibid* 567-8. Plastics play promising part in equipping modern plant. ANON. *Ibid* 569-71. What can we use? W. R. HUEY. *Ibid* 573-5. Metals and alloys with resistance to sulfates and sulfuric acid. PEIRCE D. SCHENCK. *Ibid* 575-6.—These articles make up a special no. of *Chem. Met. Eng.* devoted to a survey of recent developments in chem. engineering materials. E. J. C.

Roessler & Hasslacher - partners. ANON. *Ind. Eng. Chem.* 21, 989-91 (1929). E. C. M.

Efficiency of grinding mills. JOHN GROSS AND S. R. ZIMMERLEY. *Bur. Mines, Repts. Investigations No. 2952*, 23 pp (1929).—A method is described whereby the surface developed in grinding can be measured; results are given for 7 sizes of galena, sphalerite, pyrite and gang from 48 mesh to less than 1μ in diam. of the feed and discharge of each machine in the grinding circuit of 2 large mills. Tonnage figures for each size are also given. Classifier efficiencies for the various sizes decrease with minerals of high d, resulting in a circulating load contg. a large amt. of heavy minerals sufficiently fine for treatment. Rather high grinding efficiencies are calcd. for the mills, but, since so much of the work (90%) is expended in grinding to a size smaller than necessary, the useful efficiency is only about 4%. ALDEN H. EMERY

Chemistry and war: gas warfare. ANDRÉ DUBOSC. *Bull. soc. ind. Rouen* 57, 22-7 (1929).—A brief address outlining the elaboration of the war gas industry in France in 1915-18. A PAPINEAU-COUTURE

Silicosis with a low incidence of tuberculosis. EMERY R. HAYHURST, DANIEL J. KINDEL, BYRON E. NEISWANDER AND CLARENCE D. BARRETT. *J. Ind. Hyg.* 11, 228-44 (1929).—Sandstone quarries in Lorain county, Ohio, have been worked for over 50 years. On the basis of x-ray studies, pulmonary pathology was found in 55.1% of the cases including 28.5% with silicosis and total tuberculosis of 1.9%. General disability was low. The incidence of tuberculosis agrees with that of the community. Silicosis has a development time of 16.24 yrs., which is 2 times as long as elsewhere. In 260 cases of silicosis, 13 had tuberculosis—about 5%. The rock has 92.1-97% cryst. silica (SiO_2). The crystals are obtuse rather than acute angled; the matrix (3-8% of the total mass) consists of carbonates, silicates, kaolin-yielding substances and Fe sulfides and oxides. FRANK MARESH

Experimental pneumokoniosis. IV. Separation of matter smaller than screen sizes into graded sizes. DONALD E. CUMMINGS. *J. Ind. Hyg.* 11, 245-56 (1929).—

Dust screened through a 270-mesh screen and a diam. below 50 mesh was spread on a flat dish and worked up into a smooth paste with 50% EtOH. The paste was diluted to 1 l. with H₂O and stirred to form a homogeneous suspension. At intervals of 1, 2, 4, 8, ... min. of settling, the supernatant soln. was drawn off and allowed to settle; at intervals of 24, 48 and 96 hrs., these solns. were again decanted. The suspensions were cleansed by resuspending them in an EtOH-H₂O soln. and redécanting them. The clear sediment was dried in an oven and transferred to glass-stoppered bottles. Further cleansing may be necessary. Particles of any size may be collected by detg. the sedimentation time with Stokes equation. Theoretical limits of the method are discussed. A chart is given for detg. the settling times for quartz particles of different sizes. F. M.

Lumber and skin irritation. K. TOUON. *Naturwissenschaften* 17, 371-5(1929).—Skin irritations frequently occur in the handling of tropical wood species. They are caused by an alkaloid (chloroxylonine) in "satinwood," by free unsatd. resinic acids in teakwood and by flavones in cocobolo wood. For several other species the agent is unknown. B. J. C. VAN DER HOEVEN

Poisoning from commercial methyl chloride. EMERY R. HAYHURST. *Am. J. Pub. Health* 19, 1048-51(1929). J. A. KENNEDY

Periodic-absorption refrigerating machines. K. LANGE. *Z. ges. Kälte-Ind.* 36, 149-54(1929).—A theoretical discussion of the H₂O-NH₃ and the CaCl₂-NH₃ systems. F. D. ROSSINI

Insulated magnet wires. A. R. DUNTON AND A. W. MUIR. *Electrician* 103, 295-7(1929), 6 illus.—A record of the properties, development and uses of enamel, cotton, silk, artificial silk, paper and asbestos coverings. A no. of useful tests are described. C. G. F.

Heat conduction problems (GRIFFITHS) 2. Physiological response attending exposure to vapors of Me bromide, Me chloride, Et bromide and Et chloride (SAVERS, *et al.*) 11H.

ULLMANN, FRITZ: *Enzyklopädie der technischen Chemie. Band III. Calcium Cyanamid-Druckerei.* Berlin: Urban & Schwarzenberg. 828 pp. Paper, M. 40; bound, M. 48. Reviewed in *Ind. Eng. Chem.* 21, 889(1929).

Recovering volatile products. JACQUES DELPECH. Fr. 659,477, Dec. 16, 1927. Volatile products such as those obtained in the artificial silk industry which have been recovered by active charcoal are distd. from the charcoal in the presence of inert gases to prevent explosions.

Purifying gases. CHARLES J. RAMSBURG (to Koppers Co.). U. S. 1,727,559, Sept. 10. Gas which is to be purified is passed through a mass of non-reacting solid material permeable by and drenched with a soln., e. g., Na₂CO₃, which is reactive with the impurities in the gas; the soln. is discharged and regenerated by heating and aeration, and the non-reacting material is intermittently drenched with the regenerated soln. An arrangement of app. is described. Cf. C. A. 23, 3996.

Purifying gases. CONSTANTIN CHILOWSKY. Fr. 659,469, Dec. 15, 1927. Gases from the partial combustion of heavy oils with O are purified for use, e. g., in explosion motors, by passing them through large sectioned externally cooled metallic tubes. Cf. C. A. 23, 693.

Air purification. I. G. FARBENIND. A.-G. Fr. 659,173, Aug. 20, 1928. Odors arising in the manuf. of mercaptan and other chem. products are removed by passing the vapors thereof mixed with air over heated contact substances.

Filtering out irritant particles from air or other gases. A. L. DOTTER (to Mine Safety Appliances Co.). Brit. 307,428, March 7, 1928. A filtering layer is used comprising cellulosic material such as sawdust and cracked or crushed grains. A gas mask canister construction is described.

Desulfurizing gases. SOC. INTERNATIONALE DES PROCÉDÉS PRUDHOMME-HOUDRY. Fr. 34,408, Sept. 27, 1927. Addn. to 639,774 (C. A. 23, 678). In regenerating metallic oxides used for desulfurizing gases a local elevation of temp. is assured by the provision of a chamber contg. pure metal, which is put in circuit during regeneration, or by a reserve maintained by stopping the purification before the gases to be purified reach the zone contg. the reserve. Cf. C. A. 23, 4514.

Absorption of nitrous gases. THEOPHILE SCHLOESING. Fr. 659,489, Dec. 17, 1927. Nitrous gases are absorbed by lime in the dissolved state instead of as milk of lime.

Gaseous reactions. SOC. INTERNATIONALE DES PROCÉDÉS PRUDHOMME (S. I. P. P.).

Fr. 34,448, Sep. 27, 1927. Addn. to 632,379. An atomizing or ionizing filter is provided for each of the gaseous elements entering into reaction in a common chamber with or without a catalyst. One atomizing filter can be put in or out of circuit and forms a priming chamber at the entrance of the reaction chamber for the gradual reactivation of a catalyst contained in the reaction chamber.

High-pressure reactions. I. G. FARBENIND. A.-G. Fr. 659,582, Aug. 28, 1928. High-pressure reactions using high temps., particularly those operating in the presence of H, are carried out in double walled vessels, one or both walls being made of special steel such as V2A.

Transfer of liquefied gases from one receptacle to another. GES. FÜR INDUSTRIEGASVERWERTUNG. Brit. 307,070, March 2, 1928. Gas pressure is momentarily generated to effect transfer of liquid. An app. is described.

Purifying liquids. AKTIEBOLAGET SEPARATOR. Fr. 659,196, Aug. 21, 1928. In the purification of liquids by centrifuging, the rinsing liquid is introduced periodically into the bowl of the separator during centrifuging, and it is caused to pass out at the place where the impurities are deposited in order to drive out the solid impurities, thus prolonging the period between 2 consecutive cleansings of the bowl. The rinsing liquid may have an emulsifying substance added thereto.

Heating liquids. AAGR JENSEN. Fr. 659,539, Aug. 25, 1928. Liquids are heated by an electrically heated rotating coil which agitates the liquid while heating it.

Separating liquids. SOC. ANON. DES CHARBONS ACTIFS ÉDOUARD URBAIN. Fr. 659,857, Jan. 8, 1927. The sepn. of mixts. in different phases is accomplished by the use of capillarity, adsorption and contact electrification. Substances having a capillary structure which may be used are charcoals, earths, SiO_2 , glass powder, animal, vegetable or metal fiber or colloidal ppts. of substances such as resins.

Separating solids of different densities by use of a perforated reciprocating table through which air currents are passed. H. M. SUTTON, W. L. STEELE and E. G. STEELE. Brit. 307,526, Nov. 10, 1927. Mech. features.

Emulsions of liquid or dissolved inorganic substances. BERTHOLD REDLICH. U. S. 1,729,185, Sept. 24. A powdery inorg. substance of great absorptive capacity such as dried colloidal ptd SiO_2 , Fe_2O_3 , or Al_2O_3 is ground with substances to be emulsified, such as an oil, and the mixt. is stirred with water.

System for drying press cake from chemical processes or other materials with a gas current which conveys the dried particles from the drying zone. WM. J. HARSHAW and CHARLES S. PARKE (to Harshaw Chemical Co.). U. S. 1,729,424, Sept. 24. An app. is described.

Removing oils, fats, resins, etc., from fibrous and other materials. E. C. DUHAMEL and COMPAGNIE GENERALE DES INDUSTRIES TEXTILES. Brit. 307,360, March 5, 1928. The reconditioning process for wools, soiled fabrics, etc., described in Brit. 240,477 (C. A. 20, 2253), in which the fibrous materials are treated with concd. suint, is applied to the treatment of flax, china grass, nettles, bark and the like for removal of resins. Oils, fats, resins, waxes or essences are similarly removed from minerals such as shales or oil bearing sands, wood fibers, fish meal and waste from the treatment of tallow, beeswax and paraffins. The suint liquor is used at a temp. of about 60° and at 6° B \acute{e} , and is purified for reuse and recovery of the sepd. materials.

Protecting furnace brickwork. RALPH S. MOORE (to American Smelting and Refining Co.). U. S. 1,727,482, Sept. 10. Furnace brickwork is protected from the erosive action of charges burned in the furnace by inserting into the furnace a neutralizing material in dust form.

Protective colloid. CHEM. FAB. FLORSHEIM H. NOERDLINGER A.-G. Ger. 481,926, Nov. 1, 1925. A protective colloid is prepd. from the pitchy product obtained by evapg. sulfite lye by melting it with caustic alkali, dissolving the mass in water, pptg. with acid and redissolving the ppt. in alkali.

Sol formation. RENÉ A. HENRY. Fr. 658,306, June 13, 1928. In the prepn. of sols by placing amylaceous materials in the presence of basic salts, the sensitiveness of the materials to attack is regulated by a hot or cold treatment and then led into a liquid to form a suspension which is placed in the presence of a basic soln. The suspension is obtained and maintained by means of a pump working in a closed circuit; the contact between the suspension and the basic soln. is effected by their common flow in a channel in which the speed of flow and length of path travelled can be regulated. The sols are used for concg. materials in suspension in a liquid to be clarified. Cf. C. A. 23, 2514.

Loading telephone cables. W. S. SMITH, H. J. GARNETT and H. C. CHANNON. Brit. 307,087, Sept. 2, 1927. To enable transmission over distances such as 2000 miles,

cables are loaded with tape less than 0.0015 in. thick formed of loading alloy such as that described in Brit. 284,789 (C. A. 22, 4454). To reduce leakage, the cable is insulated with a mixt. of gutta-percha and balata treated to remove all protein and cellulose by dissolving the gum mixt. in C_6H_6 or petroleum hydrocarbons and removing the impurities as sediment or by filtering and evapng. the solvent. Tannin may be added as preservative. The interstices of the loaded cable are filled, before converyng, with a pressure-equalizing medium which may contain petroleum jelly, rubber, gutta-percha and balata, resin, etc.

"Iceless" refrigerator. ALBERT RIVARD (37.5% to Gaston Rivard and 25% to Romain Lanthier). U. S. 1,728,364, Sept. 17. Superposed trays in the refrigerator cabinet contain a mixt. of $NaNO_3$ and gravel to which access of moisture is permitted.

Refrigerating system. ERNEST B. MILLER and WALTER L. EDEL (to Silica Gel Corp.). U. S. 1,729,083, Sept. 24. A liquid such as water from brine is evapd. and the vapor is adsorbed in the pores of a solid porous material such as silica gel in the substantial absence of permanent gases. The vapor thus adsorbed is liberated and liberated vapor is vented together with any permanent gases present.

Control system for refrigerating apparatus. DELCO-LIGHT Co. Brit. 306,623, Dec. 1, 1927. Various structural details are described.

Condenser construction suitable for use with refrigerating apparatus. ZENULON WIRT (one-fourth to Edward Cackley). U. S. 1,728,740, Sept. 17.

Refrigerant control valve for refrigerating apparatus. HARRY B. HULL and CLARENCE WARNER (to Frigidaire Corp.). U. S. 1,728,970, Sept. 24. Structural features.

Refrigerating apparatus of the compression type. FRANK W. ANDREWS (to Frigidaire Corp.). U. S. 1,726,791, Sept. 3. Structural features.

Refrigerating apparatus of the absorption type. THORE M. ELEVING (to Electroflux Servel Corp.). U. S. 1,727,758, Sept. 10. Structural features.

Refrigerating apparatus of the absorption type. BALTZAR C. VON PLATEN and CARL G. MUNTERS (to Electroflux Servel Corp.). U. S. 1,728,643 4, Sept. 17. Structural features.

Refrigerating apparatus of the absorption type. EDMUND ALTENKIRCH (to Siemens-Schuckertwerke G. m. b. H.). U. S. 1,728,742, Sept. 17. A glass evaporator is used, and various structural details are described.

Refrigeration system of the absorption type. ERNEST B. MILLER (to Silica Gel Corp.). U. S. 1,729,081, Sept. 24. A liquid such as water is evapd. and the vapor, in the substantial absence of permanent gases, is adsorbed in a porous material such as silica gel having pores of such size that it will adsorb water vapor under static conditions up to 10% or more of its own wt. of water when in equil. with water vapor at a temp. of about 30° and a partial pressure of about 22 mm. Hg. Cf. C. A. 23, 1454.

Refrigerating apparatus of the absorption type. ERNEST B. MILLER and WALTER L. EDEL (to Silica Gel Corp.). U. S. 1,729,082, Sept. 24.

Refrigerating apparatus of the absorption type. CARL G. MUNTERS (to Electroflux Servel Corp.). U. S. 1,729,355, Sept. 24. Structural features.

Refrigerating apparatus of the absorption type. D. G. SMELLIE (to Hoover, Ltd.). Brit. 306,833, Feb. 21, 1927. Structural features.

Refrigerating apparatus of the absorption type. C. PÜHLMANN. Brit. 306,873, Aug. 23, 1927. Structural features.

Refrigerating system of the absorption type. E. R. MITFORD and L. CRUMP. Brit. 306,879, Nov. 23, 1927. Structural features.

Refrigerating apparatus of the continuous-cycle absorption type. R. F. BOSSINI and G. MAIURI. Brit. 307,236, April 11, 1928. Inert gases such as CH_4 or a mixt. of H and N may be used with NH_3 as the refrigerant.

Refrigerating apparatus of the intermittently operating absorption type. GEORGE FERGUSON (to Sulzer frères, Soc. anon.). U. S. 1,726,699, Sept. 3. Structural features.

Insulating material. ELECTRICAL RESEARCH PRODUCTS, INC. Fr. 659,750, Aug. 21, 1928. An insulating material, particularly for submarine cables, is composed of rubber from which a large proportion of the natural N constituents and those sol. in water have been eliminated, in mixt. with substances such as lignite, wax or balata.

Insulating material. I. G. FARBENIND. A.-G. Fr. 658,657, Aug. 7, 1928. Cellulose esters of higher fatty acids such as stearic, lauric or ricinoleic acid, or their mixed esters or their ether-esters are used for making insulating materials. Cf. C. A. 23, 1971.

Insulating materials containing finely divided metals. SIEMENS & HALSKE A.-G. Brit. 306,900, Feb. 27, 1928. Fe or Ni may be distributed in paraffin by decompn. of their carbonyl compds., or B or Si may be sepd. from their hydrides by passing the latter into liquid glass or enamel.

Gutta-percha, balata and similar insulation for submarine cables. W. S. SMITH, H. J. GARNETT and H. C. CHANNON. Brit. 307,390, Sept. 2, 1927. Resins and dirt are preliminarily removed from the gutta-percha or like material by dissolving it in a solvent such as C_6H_6 or gasoline, filtering (preferably with use of a "filter aid") and chilling to ppt. the gutta-percha; or the resins may be removed first and the residue dissolved and filtered and the solvent then distd. off. An antioxidant such as tannin 1-2% may be added.

Coating organic insulators, etc. SIEMENS & HALSKE A.-G. Brit. 306,902, Feb. 27, 1928. Org. insulators such as those used for condenser foils, which are unstable at slightly raised temps., are coated with metal by deposition from the vapor of a volatile compd. such as Fe or Ni carbonyl. Coated foils thus prepd. are suitable for acoustic diaphragms.

Heat treating plastic materials such as electrical insulation. ROY E. COLEMAN (to Economy Fuse & Mfg. Co.). U. S. 1,727,964, Sept. 10. Material comprising a base constituent such as asbestos, gilsonite or pitch and a "flowability conferring agent" including a coal-tar oil or other volatile oil is heated in flowing steam, CO_2 or other inert atm. to effect curing without undue rise of temp. from polymerization. An app. is described.

14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

City planning and the water supply distribution system. E. A. WOOD. *Proc. 11th Texas Water Works School* 25-30, *U. S. Pub. Health Eng. Abstracts* E-880b, 8.—The gridiron system of water distribution mains is considered the best and most efficient. Water needs of a city and the necessary reservoirs, artesian wells, water towers, pumping and purification plants should be considered as a part of the park system and should receive adequate consideration in city planning. C. R. FELLERS

Water purification in the Low Countries. W. F. J. M. KRUL and F. A. LIEFRINCK. *L'Eau* 22, 68-74 (1929). General discussion of water purification problems and installations in Holland and Belgium. C. R. F.

Operating experiences with California water purification plants. WILFRED F. LANGELIER and JOSEPH D. DECOSTA. *Munic. News Water Works* 76, 53-7 (1929); *U. S. Pub. Health Eng. Abstracts* E-856c, 87.—Two plants supplying water to Oakland and Berkeley are in turn supplied with impounded water of high org. and mineral content. Heavy growths of plankton resulted. In p. p. m., turbidities vary from 20 to 2000; O₂ consumed, 10; color, 40; Cl absorption, 8.4; hardness, 175. The hardness is slightly greater than the alk. The reaction is pH 7.6. Ten % of 1200 tence. samples of raw water taken during 1927 was pos. for *B. coli*. The treatment is discussed. C. R. FELLERS

The alkalinity and reaction of South Bohemian waters, particularly pond waters and their soils. V. J. ŠTĚPÁN. *Akad. Zeměd.* 4, 246 (1928); *Wasser u. Abwasser* 25, 312. The lowest pH values were found in bog and wood soils and waters, the highest in chalk soils and ponds in limestone areas. Manuring produced an increased alk. (methyl orange). C. R. FELLERS

The new water laws in Mecklenburg. M. GREVEMEYER. *Wasserkraft u. Wasserwirtschaft* 1929, 184-5; *Wasser u. Abwasser* 26, 101. Regulations regulating the use, purity of water supplies including the compulsory treatment of industrial wastes to avoid contamination or pollution. C. R. FELLERS

Constantly frozen area of Siberia. E. PRINZ. *Gas u. Wasserfach* 72, 766-70 (1929). An illustrated discussion of phenomena accompanying areas in Siberia where the ground is never fully thawed, and difficulties with water supply. R. W. RYAN

Mineral analyses of municipal water supplies in Kansas. SELMA GOTTLIEB. *Univ. Kansas Bull.* 29, No. 17, 9 pp. (1928).—A tabulation showing water hardness detns. from 289 municipalities. RUSSELL C. ERB

The water supply of a division under active service conditions in Egypt. G. K. FULTON. *J. Royal Army Med. Corps* 51, 186-9 (1928); *U. S. Pub. Health Eng. Abstracts* E-880, 90.—This account deals with the problem of supplying safe water to the British troops in Egypt in 1927. The only available supply was that of very grossly polluted and highly turbid water from irrigation canals. Three water points were established about 8 miles apart, and the water was pumped by hand to galvanized Fe sedimentation tanks of from 1 to 400 gal. capacity. At intervals during filling,

alum soln. of 6 grains per gal. was added to the tanks and 8 hrs.' sedimentation allowed. The outlet from the tanks was placed about 18 in. above the bottom. From these tanks the water was distributed either to storage tanks supplying unit water carts in which it was filtered and chlorinated or to other storage tanks supplying 3 stationary regimental water carts attached to each water point. All tanks except sedimentation tanks were of the canvas type. Chlorination was effected by use of bleaching powder.

C. R. FELLERS

Surface versus ground water supplies for municipalities. W. KIERSTEN. *Proc. 11th Texas Water Works School* 73-82; *U. S. Pub. Health Eng. Abstracts* E-880, 90 (1929).—The permanency and net vol. of a stored surface water are affected by evapn., seepage and siltation. In the semi-arid regions, evapn. varies from 5 to 8 ft. per yr., with summer rates as high as 1 ft. per mo.; this loss is irrecoverable. Seepage loss is in part restored by backflow when reservoir levels are lowered. Silting of impounding reservoirs reduces available storage capacity continuously. Specific instances of such reduction of storage are given and a tabulation is included showing that losses have amounted to as much as 95% of the original vol. provided for. On the av., storage of not less than 100 acre-ft. per sq. mile of drainable area should be provided and silting be std. at the rate of 2% per yr. Smaller, well-forested or verdured drainage areas are preferable where storage is small. No well-defined remedy for siltation has been developed. Seepage varies widely with locality and may reach 30% or more. Siltation may offset seepage through reservoir bottoms to a considerable extent but usually is of little effect on slopes or side walls. The possibility of supplementing surface sources with ground supplies should not be overlooked.

C. R. FELLERS

The Bunau-Varilla system of water purification. T. H. BISHOP. *Lancet* 216, 371-3 (1929); *U. S. Pub. Health Eng. Abstracts* E-880a, 98.—The Bunau-Varilla system of water purification used by the French Army during the World War is outlined. The special features of this process, in which very small amts. of chemicals are used, are: (1) persistence for a long period of effective, if minute, doses of available Cl irrespective of the relative amts. of org. matter and disinfectant which may be brought into contact in a water sample; (2) the difference in vulnerability to eau de Javelle of organisms of the typhoid groups and the colon bacilli the latter proving the more resistant; (3) the feeble doses employed are actually or potentially available for more than 24 hrs. and during this period their destructive action continues. An explanation of the action of doses of Cl, which are so chemically inadequate and yet so practically effective, is that all chem. reactions and, generally speaking, all changes in the phys. state of bodies give rise to the emission or reception of particular rays. The authors suggest that the rupture of the NaOCl mol. produces rays analogous to the ultra-violet rays and that such special rays are the lethal agent.

C. R. FELLERS

Ozonizing water, a French practice. JOHN H. D. BLANKE. *Water Works Eng.* 81, 1105-6, 1125-6; *U. S. Pub. Health Eng. Abstracts* E-676a, 87.—When carried out with great care and attention to details, ozonization is practically as efficient as chlorination.

C. R. FELLERS

A new electric salinometer for testing drinking water. R. MAUSCHKE. *Apparatebau* 41, 145 (1929).—A description of Crockett's simple salinometer. Its operation depends on the principle that the cond. of a dil. salt soln. is proportional to the concn.

M. C. ROGERS

Practical value of research filter plant. E. G. WILSON. *Water Works Eng.* 82, 395-6, 429 (1929).—As a preliminary to building its rapid sand filtration plant to cost \$1,315,000, the city of Ottawa, Can., has constructed a permanent test plant, costing \$8250, to det. the most efficient methods of treating Ottawa River water. A detailed description is given of this plant, which consists of mixing chamber, diffusers, coagulating basins, sand filters, chem. feed app., etc., on a small scale. Filter equipment is in duplicate.

C. H. BADGER

The use of sodium aluminate in water softening by the lime-soda process. E. P. SCHUCH. *Proc. 11th Texas Water Works School* 51-2; *U. S. Pub. Health Eng. Abstracts* E-880, 91 (1929).—When water is softened with lime and soda ash, CaCO_3 is formed, which is sol. to about 25 p. p. m. but which at ordinary temp. may at first remain in soln. (supersatd.) at as much as 60 p. p. m., but gradually be deposited in sand beds or pipes. This supersatd. condition is due to the presence of colloidal Mg(OH)_2 in waters contg. Mg salts. The actn. of Al(OH)_3 will result in the pptn. of the Mg in the form of Mg aluminate, when the pH is 9, and in turn will permit the excess CaCO_3 to come out of soln. Hence, the addn. of sufficient Na aluminate to give the water a pH value of 9 or more will ppt. all the Mg and thereby reduce the soly. of CaCO_3 so that the remnant hardness will be as low as 25-30 p. p. m. However, an excess of Na aluminate will

remove the Ca much more quickly, as an excess of aluminate will form an insol. Ca aluminate.

C. R. FELLERS

Taking hardness out of the water supply. ROBERT E. McDONNELL. *Water Works Eng.* 82, 397-8, 426(1929).—Softening water is a municipal function. No investment has given greater returns and none has proved as popular. The original investment per capita for municipal softeners is $\frac{1}{10}$ that of house softeners, and the operating costs, $\frac{1}{20}$. At least 1% of the total water supply is used as a cleansing agent. It costs about 10% more to add softening equipment to municipal filtering equipment. The cost of softening water, together with Fe removal and recarbonation, is in many cases 1 to 2¢ per 1000 gals. Softening and coagulating basins have a higher bacterial efficiency than single coagulating basins. Generally, no advantage is gained in removing total hardness below 75 to 100 p. p. m. The savings in the household where soft water is used are discussed. The av. family may have soft water at a cost of 7¢ per month.

C. H. BADGER

Field practice in chlorination of new and old water mains. J. S. STROHMEYER. *Hydraulic Eng.* 50, No. 8, 34-6(1929).—Operation and app. required for chlorination of water pipe lines are described. The cost is 1 cent per foot using hypochlorite of lime and 2 cents using Cl gas. Also in *Surveyor* 76, 147(1929).

E. I. S.

Manganese dioxide problem in the Catskill water supply. FRANK E. HALE. *Water Works Eng.* 82, 1166, 1178(1929); cf. *C. A.* 23, 657—Deposits which interfered with the flow of water in the Catskill aqueduct between Ashokan and Kenisco Reservoirs became detached in large areas and reduced in thickness when the water was chlorinated. The flow was increased from 400 to 600 m. g. d. about the same date chlorination was begun. No new deposits between the old and new water levels were found until 37 miles below the point of chlorination. At 48 miles below, the entire surface was again covered. Chem. analyses of 4 representative chocolate-colored deposits showed that they consisted of MnO_2 with smaller quantities of Fe_2O_3 and Al_2O_3 , together with sand and cement loosened from the surface of the concrete. Seven samples showed no microscopic plant growth or org. structure. The deposits are believed to be due to the cement forming an alk. reaction in the water next to the walls. The Catskill supply and the Croton supply analyzed, resp., 0.04 and 0.08 p. p. m. Mn. Addnl. chlorination is under consideration.

C. H. BADGER

Some results of boiler water conditioning. R. E. HALL. *Iron Steel Eng.* 6, 380-9 (1929), cf. *C. A.* 23, 4985. A summary and discussion of the Hall system of boiler water conditioning, with numerous examples of its practical application. R. E. H.

Improved equipment for the treatment of feed water for modern steam boilers. JOSEPH D. YODER. *Ind. Eng. Chem.* 21, 829-34(1929).—Proper feed water treatment is important for the modern high-pressure boiler, operating at 400-1200 lbs per sq. in. pressure. Practical methods are given for treating water with phosphate to supplement the lime and soda treatment and also deaeration. A description is given of a H_2SO_4 feeding equipment to establish a proper relationship of Na sulfate to Na carbonate for use with zeolite softening or with natural water high in Na carbonate. A. H.

Laboratory experiments with a foaming boiler water. A. S. BEHKMAN. *Ind. Eng. Chem.* 21, 817-8(1929).—The removal of org. coloring matter from boiler water shows great improvement as regards foaming.

ALFRED HIRSCH

The mechanism of formation of calcium sulfate boiler scale. EVERETT P. PARTRIDGE AND ALFRED H. WHITE. *Ind. Eng. Chem.* 21, 834-8(1929).—A new theory of scale formation is given which states that the first step is the deposition of crystals in direct contact with the heating surface.

ALFRED HIRSCH

Thermal effects of boiler scale. EVERETT P. PARTRIDGE AND ALFRED H. WHITE. *Ind. Eng. Chem.* 21, 839-44(1929).—New detns. of the coeff. of heat cond. of $CaSO_4$ scale made in an exptl. boiler at pressure up to 150 lb. per sq. in. gage are reported. While scale is relatively unimportant from the standpoint of loss in heat utilization, it is very important from the standpoint of temp. in the metal of scaled heating surfaces. A simple graphical soln. of the heat flow equation is given for the rapid estn. of metal temp. increases caused by different rates of heat transfer, for scales of different thickness and heat conductivities. Illustrations of the app. employed, photomicrographs of $CaSO_4$ and $CaSO_4 \cdot \frac{1}{2}H_2O$ scale and several tables and graphs are included. E. G. R. A.

Caustic embrittlement vs. the true cause of boiler-plate failures. E. F. BAKER. *Eng. & Finance* 21, 80-4(1929).—When boiler water contains both caustic and oil, as is frequently the case, a very non uniform circulation of the water is likely to take place. This causes a rising and falling of the water in the boiler with resultant impact. The strains set up by these rapid impacts cause failures which have been frequently incorrectly laid to caustic embrittlement.

LESLIE B. BRAGG

Corrosion and how to prevent it. J. W. McAMIS. *Water Works Eng.* **82**, 585-6 (1929), 619 (1929).—A simple explanation is given of the electrochem. theory of corrosion of Fe pipes by water. Rust formation is usually tight and dense in hard or alk. waters. Waters are made non-corrosive by adding a slight excess of lime to combine with the CO_2 present in the water to form a protective ppt. of CaCO_3 and MgCO_3 . Similarly, Na_2CO_3 is needed to react in waters contg. much CaSO_4 and MgSO_4 to form CaCO_3 and MgCO_3 . C. H. BADGER

Cause and prevention of corrosion of transformer cooling coils. H. EICHHORN. *Elektrizitätswirtschaft* **1928**, 457-9; *Wasser u. Abwasser* **25**, 303-4.—A general discussion. C. R. FELLERS

The corrosive action of water on pipe lines. H. WINKELMANN. *Apparatebau* **41**, 146 (1929).—Corrosion is increased considerably by the presence of air. The mechanism of rusting is explained as it occurs in industrial installations. The importance of removal of the air from water is stressed. M. C. ROGERS

It does not pay to return boiler blow-off to the feed-water softener. J. D. YODER. *Power* **70**, 442-3 (1929).—The mixt. of substances in blow-off is not useful for further softening. D. B. DILL

Additions to mechanical equipment at Baltimore sewage pumping station. C. E. KEEFER. *Eng. News-Record* **103**, 333-5 (1929).—The topography of Baltimore is such that it is necessary to pump approx. half the sewage flow. Recent addns. to the pumping equipment are described. The return of condensate from the main pumping engines to the boilers had to be discontinued some years ago on account of blistering of the boiler tubes due to oil in the condensate. In order to enable a return to this practice, pressure filters contg. sand and gravel have been installed to remove the oil. Alum and lime are applied to the condensate before the latter passes to the filters. The filters are cleaned by backwashing. R. E. THOMPSON

Activation of sludge by mechanical aeration. W. D. VOSBURY AND PHILIP B. STREANDER. *Munic. News Water Works* **76**, 171-5 (1929); *U. S. Pub. Health Eng. Abstracts* **E-856b**, 75.—A discussion of sewage treatment methods with special emphasis on activated sludge. Only 7% of the air which is blown through sewage is used for oxidation. The remaining 93% serves only for agitation. Attention is called to the advantageous use of mech. aerators ahead of sprinkling filters when the latter become overloaded. A plant is under construction with a capacity of 600,000 gal. per day, costing \$97,000. The plant is provided with sedimentation tanks having a detention period of 1 hr. The aerators are of novel design in which special paddle wheels rotate at one side of the tank drawing the liquid up through a narrow compartment and driving it across the tank, which gives a spiral circulation with a bottom velocity of about $1\frac{1}{2}$ ft. per sec. A detention period of 6 hrs. is allowed. In this type plant the aeration of the sewage is accomplished by the repeated exposure of broken surfaces to the atm. The aerated mixed liquor is passed into Link Belt settlers from which the deposited sludge is returned by air lift. The effluent is discharged to rapid sand filters identical with those used in water works practice with a total area of 280 sq. ft. The effluent from the aerators passes to a contact tank for chlorination with a contact period of 30 min. Sludge is disposed of by digestion and drying under glass. It is proposed to pass activated sludge without digestion directly to drying beds during the summer months. The digestion tank is of novel design, being divided into channels so that the sludge entering must flow through a considerable distance. Gas is collected and used for heating the sludge. Provision is made for drawing off liquor at 6 in. intervals. C. R. FELLERS

Low-temperature pasteurization with special reference to the destruction of epidemic agencies. H. ZELLER, W. WEDEMANN, L. LANGE AND E. GILDERMEISTER. *Bull. Hyg.* **4**, 131 (1929); *U. S. Pub. Health Eng. Abstracts* **E-880b**, 34.—In large scale expts the infective agencies of foot and mouth disease, contagious abortion, calf diarrhea, typhoid-paratyphoid-Gartner group and *B. coli*, when exposed to temps. of 60-63 for 30 min., were completely destroyed. Pasteurization, although bringing about a great diminution of the infectivity of the tuberculous materials used in the expts. on animals, cannot be relied upon to kill off the organism completely. C. R. F.

The Helsingfors swimming pool. R. KREÜGER. *Tek. Foren. Finland Forh.* **49**, 149-51 (1929).—The purification system consists of an aerating tank, a filter for removing hair and a pressure filter. Cl gas (0.2 p. p. m.) is injected immediately after the filter so the water reaching the basin is free of bacteria. The daily heat losses are eqv. to a temp. drop of $\frac{1}{2}$ -1°, which is made up by adding warm water. H. C. D.

Typhoid fever in a rural village of Porto Rico due to a surface well. E. GARRIDO MORALES. *Am. J. Pub. Health* **19**, 997-1004 (1929). J. A. KENNEDY

Typhoid fever outbreak in Fort Wayne, Ind., due to dual valve connection. RUTH C. STURTEVANT. *Am. J. Pub. Health* 19, 1044(1929). J. A. KENNEDY

Practical application of Paris green as a larvicide for anopheles larvae on an impounded lake in Alabama. D. G. GILL, C. C. KIKER AND L. C. SIMS. *S. Med. J.* 22, 399-404(1929); *U. S. Pub. Health Eng. Abstracts E-856*, 29.—Powd. soapstone was selected as a diluent, after consideration of hydrated lime, kaolin and road dust. A 5% mixt. of Paris green was found more suitable than a 1% mixt. The Paris green was satisfactory as to As_2O_3 content (a min. of 50%). It was satisfactory as to fineness, but the authors recommend that specifications require Paris green to pass a 300-mesh sieve instead of a 200-mesh. Because of wave action, wind currents and surface tension, Paris green is not equally effective on all areas. C. R. FELLERS

Oil mixtures and oil equipment for anopheline larvae control of impounded areas. I. M. CLARKSON. *S. Med. J.* 22, 397-8(1929); *U. S. Pub. Health Eng. Abstracts E-856b*, 29.—Different mixts. of fuel oil and kerosene were first used with poor results. Excellent results were finally obtained by the use of a mixt. of 20% black oil for maintaining the film, 20% kerosene for toxic effect and 60% paraffin oil for spreading. C. R. FELLERS

The chemist and the disposal of waste products. V. G. ANDERSON. *Proc. Soc. Chem. Ind. Victoria* 27, Nos. 1-4, 1381 6(1927).—This paper is a general discussion on the disposal of trade and municipal wastes with particular reference to conditions in Victoria. K. D. JACOB

The control of noxious trade premises, including the collection and disposal of wastes dealt with. E. A. CRESSWICK. *Proc. 1st Commonwealth Conf. Pub. Health Emp. Australia* 212 23, *U. S. Pub. Health Eng. Abstracts E-880*, 15(1929).—A discussion is given of the modern methods of reducing the offensiveness of the operations in the following trades: blood boiler, blood drier, bone boiler, bone grinder, fat extractor, fat melter, flock maker, glue maker, gut scraper, knacker, manure maker, pig keeper, poultry farmer, rag dealer, rag picker, soup drier and wood scourer. C. R. FELLERS

Purification of effluents from beet sugar factories, with special reference to fisheries. J. GLASSNERICH. *Fisheries Ztg* 29, 419, *U. S. Pub. Health Eng. Abstracts E-880*, 80.—Expts. were undertaken to ascertain whether it is better to purify the beet-washing wastes by passing them slowly through tanks of several days' capacity in relation to flow or to allow settlement for 1 or 2 hrs. After letting a waste, contg. 7.12 p. p. m. of O_2 in soln, stand for 23 hrs., 1.84 p. p. m. of O_2 remained, while, after passing it through tanks, the O_2 was reduced to 0.422 p. p. m. The beet washing waste is most dangerous when it is decomposing and fermentation has begun. After the fermentation is completed it is less harmful. Complete fermentation out in the open air takes longer in winter than in summer. Effluents from beet sugar factories must never be passed into streams until they are completely purified and free from all putrescible org. material. C. R. FELLERS

The treatment of the waste waters of a sugar factory with chlorine. ERNST NOLTE. *Z. Ver. deut. Zuckerind.* 79, 463 6(1929), cf. *C. A.* 23, 4003.—The results of some chlorination tests on a large scale are given. Chlorination of waste waters does not destroy or eliminate org. matter from the water, but H_2S and sulides which cause mal-odor are destroyed. Fresh waste waters when chlorinated do not ferment. They contain substances which can hardly increase molasses formation; thus, they may be recirculated for diffusion. Intermittent chlorination is more economical than continuous chlorination. Dead corners in the drain serve as breeding grounds for bacteria, and so may reimpregnate the water and defeat the aim of the chlorination process. Complete fermentation methods of purification were used successfully. Fermentation, liming and chlorination methods may prove useful in recovering waste waters where there is a shortage of water. F. CAMPS-CAMPINS

Views on the proposal of Dr. Bach relative to the rendering of the waste waters of beet sugar factories harmless. PAUL HIRSCHFELDER. *Z. Ver. deut. Zuckerind.* 79, 420 1(1929), cf. *C. A.* 23, 4362. H. points out that fungi and algae formation is also responsible for the trouble caused by introducing the waste waters into streams. These fungi and algae may foul turbines. Streams in which the water is well aerated by flowing over obstacles are especially rich in algae and fungi. These streams may be perfectly clear, fouling and fermentation occurring only in dead corners. Fishermen claim that the fungi drive away fish. In some streams, where the flow of water is very slow, O_2 may be deficient for the life of fish, but aeration causes the growth of algae and fungi. A remedy in one factory may fail completely in another; each case must be decided by expt. Even injection water from the condensers, when introduced into

streams, causes the growth of fungi and algae. Aeration is not a soln. to the problem in every case.

The fishery and the pollution of sea water by petroleum. ODON DE BUEN. *Inst. Españ. Oceanografía, Notas y Resúmenes*. [2], No. 31, 10 pp. (1929).—Petroleum and heavy oils are qualified to change the biological conditions in the sea water. The actual pollution does not have any effect on the life and the propagation of the fish, or on their eggs or on the zooplankton. The petroleum may transmit a disagreeable taste on the sea animals.

Glasgow's 720-ton refuse incinerator. M. N. BAKER. *Eng. News-Rec.* **103**, 345-6 (1929).—A brief description of the new refuse disposal works at Glasgow, Scotland, which consists of revolving screens, an electromagnetic separator for removing metallic articles from the tailings, swinging-hammer pulverizers and a 40-cell destructor plant fully equipped for heat utilization. The pulverized tailings and fine screenings are discharged into the destructor cells together. The clinker is used as aggregate for concrete. Electricity generated in excess of that necessary for plant operation, including charging of the electrically operated collecting vehicles, is sold to the electricity department.

Some notes on the collection of London (England) refuse. F. W. CABLE. *Munic. Eng. Sanit. Record* **83**, 88-9 (1929).—Brief description of refuse collection in congested areas, particularly in the City of Westminster.

St. Louis reduces smoke 65 per cent. OSBORN MONNETT. *Power* **69**, 1011 (1929).—The smoke ordinance was strengthened and an increased staff provided.

D. B. DILL

Analyses of waters during 1928 (TOCHER) **15**. Softening industrial water for textile purposes (TROTMAN) **25**. The character, properties and possible uses of bentonite [as water softener] (WOODMAN, TAYLOR) **18**.

KELLER, HERMANN. *Gespannte Wässer*. Halle (Saale): Wilhelm Knapp. 90 pp. Reviewed in *J. Am. Water Works Assoc.* **21**, 1263 (1929).

Tank filter for water or other liquids. CHARLES G. HAWLEY (to Centrifix Corp.). U. S. 1,726,827, Sept. 3. Structural features

Chemical filter for water, etc. AKTIEBOLAGET FILTRUM. Fr. 659,332, June 30, 1928.

Household water filter and strainer. FRANK KASZTORY (one half to Ignatius Izsak). U. S. 1,726,839, Sept. 3. Structural features

Apparatus for regulated chlorination of water, etc. G. D. PEET (to Wallace & Tiernan Co.). Brit. 307,473, March 8, 1928. Various structural details are described.

Chemical water softeners. UNITED WATER SOFTENERS, LTD. Fr. 659,794, Aug. 31, 1928. The regenerating salt is made into a mud and injected into the water softening app. Other details are described.

Base-exchange material. ALPHONS O. JAEGER (to Selden Co.). U. S. 1,728,732, Sept. 17. A physically homogeneous product suitable for water softening and catalytic uses contains a zeolite, which is the reaction product of at least one sol silicate, at least one metallate and at least one salt, the basic radical of which contains a metal capable of forming part of the non-exchangeable nucleus of a zeolite—the zeolite is formed in a reaction maintained non acid to phenolphthalein and it is dild. with a substance which forms with it a homogeneous structure. Numerous examples and details are given. Cf. C. A. **23**, 247.

Electric system for preventing incrustations and corrosion of steam boilers or other metal surfaces. FRIEDRICH HAUPTVOGEL. U. S. 1,726,738, Sept. 3.

Sewage treatment and destructive distillation. E. VON SPRINGBORN. Brit. 307,582, Jan. 19, 1928. Sewage is filtered through combustible material (such as coal, peat, wood, coke or charcoal) and the latter, impregnated with sewage matter, is burnt at a temp. of dull redness in a limited supply of air and steam; gases given off are condensed for recovery of various products. KNO₃ may be used on the filtering material to promote oxidation. An arrangement of app. is described.

Apparatus for aerating sewage. KARL IMHOFF. U. S. 1,727,601, Sept. 10. Structural features, including a submerged oscillating aerating pipe.

Plant for screening and disintegrating sewage which is to be discharged into the sea. PULSOMETER ENGINEERING CO., LTD., and J. BJÖRNSTAD. Brit. 307,561, Dec. 20, 1927. Structural and mech. features.

Treating industrial waste waters. AKTIESELSKABET DANSK GAERINGS INDUSTRI. Brit. 307,587, Jan. 25, 1928. Waste waters are purified by successive stages of treatment, in each of which a different microorganism is used; e. g., starch present may be first decomposed into glucose or maltose by a suitable organism, sugar then decomposed with yeast, albumin and urea then broken down by use of *Bacillus putrificus* or *Bacillus vulgaris* and the products converted into NH_3 by *Bacillus mycoides*, formic acid broken up by *Bacterium formicicum*, and the NH_4 salts finally oxidized by treatment with cultures of nitrosomonas and nitrobacter. Various details and modifications of procedure are described.

15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

The soil in Hedemark, Norway. IVAR A. STREITLIEN. *Meldinger Norges Landbruks* 8, 365(1928).—The soil is examd. and chem. analysis given. A. D.

The revised official British method for mechanical analysis (of soils). ANON. Sub-committee of the Agr. Education Assoc. *J. Agr. Sci.* 18, 734-9(1928).—An account is given of certain developments making desirable further modifications of the official method of 1925 (*C. A.* 20, 3055; *Agr. Progress* 3, 106-10(1926)). The new method as adopted has already been published (*Agr. Progress* 5, 137-44(1928)). The principal changes are the substitution of oven dry for ignited wts. and the no. and dimensions of the fractions. The details of the new method, so far as they differ from the 1925 method, are given in an appendix. P. R. DAWSON

"Single value" soil properties: A study of the significance of certain soil constants. B. A. KREN and J. R. H. COUTTS. *J. Agr. Sci.* 18, 740-65(1928).—An account is given of a detailed investigation on 39 soils of certain "single value" detns. The following measurements were made: percent of clay; moisture content of soil in equil. with atm. of 50% relative humidity; ignition loss of dried soil; moisture content at the "sticky" point (defined as the point at which a thoroughly kneaded plastic mass of soil is just about to stick to the fingers or to a knife). The method of vol. shrinkage developed by Haines was used to obtain the following: moisture content of the satd. plastic block; the pore space, true and apparent sp. gr. of oven-dried block. The CaCO_3 present in each sample was detd., as well as the total C content in a number of instances. The main results are as follows: In spite of wide variations in clay and org. matter content the pore space of the kneaded blocks when oven dry falls closely around a mean of 26%. This is reduced by 4-5% on the H_2O_2 -treated soils, probably due to the ability of the grains to slip into closer packing under the influence of the thorough kneading, when the org. matter has been removed by the H_2O_2 . For the whole series of soils, however, the reduction of pore space is not related in simple manner to the amt. of org. matter removed. Treatment with H_2O_2 removes about 75% of the total org. matter of the soil. Correlation coeffs. obtained for the various pairs of quantities examd. express the general fact that the heavy clay soils have the highest ignition losses, moisture contents and sticky points. An increased correlation between clay and sticky point for the H_2O_2 -treated soils suggests that the sticky point value is controlled both by the org. matter and some property related to the clay content. When the associations are further examd. by partial correlation coeffs. the sticky point is shown to be largely controlled by the colloidal org. and inorg. colloidal material, while the moisture content at 50% relative humidity is largely controlled by the actual clay content. There is independent evidence that this moisture is held in the minute interstices between the clay particles. The sticky point approaches a lower limit of about 16% moisture content with very sandy soils contg. little org. matter. This value is close to 14.6% which is the satn. moisture content of an ideal soil in closest packing, and it was shown that the pore spaces of this ideal soil and of the kneaded blocks of actual soil have approx. the same value. Hence, the value of the sticky point moisture content is made up of (a) 16% of H_2O held in the pore space (unassociated with colloidal material), and (b) H_2O associated with org. matter and inorg. clay colloids. A comparison of the variation of sticky point detns. made by different workers shows that satisfactory agreement can be secured after a little experience with the method. The importance is stressed of introducing single value methods as an adjunct to the modern system of soil classification, and into soil physics. P. R. DAWSON

The properties of heavy alkaline soils containing different exchangeable bases. A. F. JOSEPH AND H. B. OAKLEY. *J. Agr. Sci.* 19, 121-31(1929).—The nature of the

replaceable base in a clay or soil exerts a profound effect on the phys. properties. Clay-like properties are exhibited most strongly with Li, Na and Mg. The proportion of fine material in a soil (that remaining in suspension in a 10 cm. column after 14 days) cannot be correlated with other phys. properties. Thus a soil of which over 50% was dispersed to this extent was the least plastic of those examd. A comparison of Na, K and Ca clays and soil showed that K resembles Na in its chem. relationships as indicated by base exchange, but is very different from it in such phys. properties as plasticity and permeability. With mixts. of 0.5 N chlorides of 2 bases, Ca and K are absorbed in equiv. amt. while the Na absorbed is only $\frac{1}{6}$ of the amt. of either of the other 2.

P. R. DAWSON

The dispersion and mechanical analysis of heavy alkaline soils. A. F. JOSEPH AND O. W. SNOW. *J. Agr. Sci.* **19**, 106 20(1929).—The form of the dispersion curve obtained by a single dispersion treatment below 29 varies greatly with different soils and with the same soil satd. with different bases. There is no connection between the proportion of very fine material (below 0.59) and other important soil properties. The proportion of the very fine material detd. in this way would not afford any indication of the "colloid" properties of the soil. If the proportion of fine material was estd. by a decantation method the results might be substantially modified. Under the same conditions of dispersion Na soil is better dispersed than NH_4 . Na_2CO_3 should, therefore, be the best medium for mech. analysis. No case has been encountered where the proportion of clay found is affected appreciably by the use of H_2O_2 . The no. of decantations was not reduced by the use of acid pre-treatment with any soil tried; those examd. gave the same clay content if sufficient puddlings with Na_2CO_3 were used with or without acid. No method has been found whereby certain soils can be dispersed in a single operation as is required in the pipet method. In some cases this is due to gypsum, but there are others in which the cause of the difficulty is not known. In the cases examd. Na_2CO_3 gives a higher result than NH_4OH when the International pipet method is used. For Sudan soils decantation methods appear essential, H_2O_2 unnecessary, acid pre-treatment not essential and Na CO better than NH_4OH .

P. R. DAWSON

The characteristics of the soils from the experiment stations in the non-chernozem belt of the Russian Union of Federated Soviet Republics in connection with liming experiments. D. V. DRUZHININ AND N. E. KARGOPOLTSEV. *Trans. Sci. Inst. Fertilizers* (Moscow) No. **61**, 28 34(1929).—Analyses of soils from 13 expt. stations engaged in a cooperative liming expt. brought out the following characteristics of these soils: (1) The soils could be divided according to their degree of unsatn. into 3 groups: (a) highly unsatd. with bases, (b) medium and (c) weakly unsatd. (2) There is a more or less direct relation between the degree of unsatn., relative value of exchange acidity, active reaction and the influence of lime on the shifting of the pH values as well as the crop yield. (3) The influence of lime on the forms of acidity in podzolized soils is not of sufficient significance to interpret data on liming.

J. S. JOHNS

Report on chemistry. G. R. STEWART. *Proc. Hawaiian Sugar Planters' Assoc.*, 48th Ann. Meeting 1928, 306 22(1929), cf. *C. A.* **22**, 3719. Soil surveys of a no. of sugar plantations indicated a more general deficiency in K than in N and P. In pot expts. lime was effective in reducing the acidity of certain soils and preventing the accumulation of Fe compds. in cane stalks. The nitrifying power of a soil could not safely be used as an index of the soil's fertility. Expts. on the sealing of cracks in the dirt bottoms of water reservoirs indicated that mech. sealing with asphalt-oil mixts. was of more universal application than sealing by dispersion of the soil colloids with salts. **Interaction of soils and fertilizers.**—Addn. of superphosphate to soils in jars resulted in an immediate increase in the P content of the soil soln., but this effect persisted only for a short time. With acid soil, the soil solns. from jars receiving applications of ground rock phosphate contained as much P as those from the superphosphate applications. With neutral soils superphosphate at times developed larger amts. of sol. P. The expts. are being continued on soils in the field. As a fertilizer for cane on poorly drained soils, nitrate of lime was far superior to other N fertilizers even when the latter were supplemented with limestone or gypsum. No correlation could be found between the failure of Lahaina cane and the chem. compn. of the soil. Pot expts. with infertile soils from the Kilauea plantation showed pos. evidence of Al or Fe toxicity, low O supply, ing power and marked deficiency in K and P. K₂O applied to these soils is converted into compds. that are much more insol. in 1% citric acid than in soils from other plantations. The impermeability of certain acid upland soils seemed to be due to the presence of excessive amts. of replaceable Mg. Applications of molasses to certain compact, poorly drained soils resulted in an increase in sol. Fe and Al salts and nitrites.

K. D. JACOB

The chemical mechanism of the reclamation of szik (alkali) soils. SÁNDOR ARANY. *Magyar Chem. Folyóirat* 35, 94-100 (1929).—Szik soils have chiefly been formed by chemical changes in the soil. Any method of reclamation consists of liming. For soil reclamation it is necessary that the most of the alkali metals contained by the soil moisture and bound by adsorption be removed. If the material used for reclaiming cannot change the peptized state, the soil is unchanged in physical structure although it is changed chemically. The chemical processes in connection with the formation of szik soils and with their reclamation prove the theory of interchangeable bases is correct.

S. S. DE FINÁLY

Liming as a factor in the amelioration of deteriorated tropical soils. P. E. TURNER. *J. Agr. Sci.* 19, 83-9 (1929).—Large areas of deteriorated soils in Trinidad, under cultivation with a single short-term crop for generations, differ but little in their content of org. matter from soils which retain their fertility. In comparison with the latter, however, they are markedly acid and highly deficient in exchangeable Ca. Detns. of the contents of exchangeable Ca and the p_H values of a series of liming expt. plots indicate that: Finely ground limestone is a more efficient soil ameliorant than slaked lime. Single relatively large applications of lime fertilizers have given more immediate beneficial results than small annual applications. The effect of liming appears to have been almost entirely restricted to the depth to which the soil is worked, probably because of the impermeability and lack of aeration characterizing heavy deteriorated soils. A significant increase in crop yield was obtained only on those plots rendered neutral in reaction by liming and on which the degree of satn. of the top 6 in. of soil was raised to 80%. This value is comparable with that of the fertile soils of Trinidad. P. R. D.

The influence of the carbon:nitrogen ratios of organic material on the mineralization of nitrogen. H. L. JENSEN. *J. Agr. Sci.* 19, 71-82 (1929).—Org. materials with a C:N ratio ranging from about 8:1 to about 10:1 were submitted to nitrification tests in an acid and in an alk. soil during a period of 6 months. In the acid soil only pea pod meal, with a C:N ratio of 13:1, showed an increase in inorg. N over the control; in the alk. soil the limit above which no nitrification occurred was at C:N = 26:1, below this limit the rate of nitrification increased rapidly with decreasing C:N ratio. Unnitrified N was left behind to the extent of 1.5-2.2% of the original material, the % being higher with materials rich in N. All the materials tended to increase the content of "α-humus" in the soil, although not to the same extent or in the same manner. More "α-humus" was produced in the alk. than in the acid soil, except with farmyard manure. Straw, sweet clover, lupin and farmyard manure apparently acted both through their lignin content and through the synthesizing action of microorganisms, since they increased the amts. of both N and methoxyl in humus. Mycelium of *Polycorus* contains a fraction possessing the properties of "humic acid," high in N, but devoid of methoxyl, which persists in the soil. The expts. show that the C:N ratio is a factor exerting an influence on nitrification as profound as that of soil reaction, and that the less complete utilization of farmyard manure N as compared with N in artificial fertilizers can to a large extent be explained thereby.

P. R. DAWSON

Biochemical methods for determining the assimilable potash, phosphoric acid and nitrogen in soils. II. The methods of H. Christensen, H. Niklas and H. Hirschberger, J. König and D. Couchack. STANISLAW HOLYŃSKI. *Mém. inst. nat. polonais econ. rurale à Palermy* 8, 529-38 (sep.) (1927). *Chem. Zentr.* 1928, I, 2649; cf. *C. A.* 21, 4001.—Catalase activity is coordinated with the growth and activity of the soil microorganisms, by a 24-hr. incubation at 30°. The method is particularly accurate in showing the activity of *Azotobacter* in the soil. The catalase is detd. by back titration, after 1 hr., of the remaining H_2O_2 with $KMnO_4$. Soil fertility may be measured with a fair degree of accuracy by biol. methods.

C. R. FELLERS

A rapid electrometric method for measuring "lime requirements" of soils. F. HARDY AND A. H. LEWIS. *J. Agr. Sci.* 19, 17-25 (1929). Ten g. of soil is mixed in a small wide mouthed bottle with 40 cc. of neutral 0.2 M $CaCl_2$ soln. The mixt. is then titrated, by use of the quinhydrone electrode, with 0.03 N lime-water in successive portions of 5 cc., with 3 mins. shaking between each addn., and the titration continued until the reaction has passed $p_H 7.0$. The results are plotted and the exact vol. of lime-water needed to give a final reaction of $p_H 7.0$ is estd. from the graph. The method is compared with the Hutchinson-MacLennan method for a series of soils of different textures and different initial exchange reactions. It appears to yield more reliable results, is less tedious, very rapid and the results obtained can readily be reproduced.

P. R. DAWSON

Experiments with micas, feldspar, and clay as potassium-containing means for improvement of the soil. PAUL SOLBERG. *Meldinger Norges Landbruks.* 8, 419-82

(1928).—Analysis and results are given. Potassic feldspar and clay have shown much less satisfactory effects than the micas. Biotite and flogopite (dark micas) are altogether superior to sericite (light micas). ARNE DROGSETH

Studies in crop variation. V. The relation between yield and soil nutrients. BH. BALMUKAND. *J. Agr. Sci.* **18**, 602-27 (1928).—By comparison with the best available data tests are made of a yield-factor relation termed, by elec. analogy, the resistance formula of the general type, $1/y = F(N) + F'(K) + F''(P) + \dots + C$, and of certain derived special formulas. It is shown that it is possible to fit the formulas to exptl. data involving the simultaneous variation of 2 factors by a sufficiently rapid method of approximation. In every case discussed the formula fits the facts within the limits of exptl. error estd. from the expts. themselves, although formulas of other types fail strikingly to do so. The parameters appropriate to each nutrient are independent of the abundance of other nutrients and are capable of direct phys. interpretation. Even in the best expts. available the sampling errors are too large to allow of estns. of available nutrients to a desirable degree of accuracy; greater precision is also desired in the importance factor. Such will be possible by increased replication and also by the adjustment of the amts. of fertilizer employed with the same no. of replicates. These constns. have great practical value, as a knowledge of them would enable the detn. of the optimum value of a nutrient for any crop under a given set of conditions. It is not claimed or considered probable that the formulas represent exactly and in all cases the response of the crop to added nutrients. The method is, however, capable of supplying information of immediate importance both about soil and about varieties. Only by much increased exptl. precision can its possibilities be exhausted. P. R. DAWSON

The reaction of soil and the cultivated plants. ÅSULV LÖNNDESTAD. *Meldinger Norges Landbruks* **8**, 123-248 (1928).—The degree of acidity of the soil is examd for a Norwegian estate, and the influence on the cultivated plants investigated. A. D.

Influence of clay on plant growth. E. BLANCK AND H. KEESE. *J. Landw.* **76**, 309-16 (1928).—In pot expts with oats the plants were at first improved and then injured, by the addn. of increasing proportions of clay to sand. Quartz sand and a pure clay contg. only traces of bases were used in mixts. of 10 0, 9:1, 8:2, 6:4 and 4:6, with the addn. of a complete fertilizer. Growth and dry wt. were greatest with the 9:1 mixt., about the same with either 10 0 or 8:2, and greatly reduced with 6:4 and 4:6 mixts. Subsequent reactions showed the sand neutral and the clay acid (p_H 4.23); the harmful action of the clay was therefore attributed to its acid nature. Emphasis was placed upon the difference in properties and action of individual clays. E. F. SNYDER

Analyses of fertilizers, feeding stuffs, waters, milks, soils, and silages during 1928. J. F. TOCHER. *Trans. Highland and Agr. Soc. Scotland* [5], **41**, 221-6 (1929).

Field and vegetation experiments with nitrogenous fertilizers in 1927. A. N. LEBEDYANTSEV. *Trans. Sci. Inst. Fertilizers (Moscow)* No. **61**, 35-60 (1929).—The sources of N were $NaNO_3$, $Ca(NO_3)_2$, NH_4NO_3 , $(NH_4)_2SO_4$, $Co(NH_2)_2$ and $CaCN_2$. The crops used were: sunflower, potatoes, cabbage, flax, cucumbers, tomatoes, hemp, oats, sudan grass, sugar beets and mixed grasses. The podzol zone as well as the zone of the northern chernozems responds favorably to N fertilizers without, and more so with, other plant food ingredients. The southern chernozem did not respond in the field expts., but the contrary was true in the greenhouse expts. The moisture factor in the south seems to be limiting; there are also other factors of a local nature. The different plants, within the limits of their resp. minima, showed one and the same response. Some plants like poppy, cotton and rice indicated their special need of P; sugar beets and tomatoes needed K. The physiologically acid N fertilizers on acid soils with K and P fertilizers which also leave acid residues decreased the yields. On neutral and alk. soils the physiologically alk. fertilizers proved more satisfactory. Urea seems to react as a physiologically acid fertilizer. J. S. JOFFE

Ammonia in fertilizers and its relation to the life of plants. D. N. PRYANISHNIKOV. *Trans. Sci. Inst. Fertilizers (Moscow)* No. **61**, 99-103 (1929); cf. *C. A.* **23**, 3489.— NH_3 enters the plant faster than nitrates, and is more easily assimilated in the synthetic process of formation of org. N compounds; with an excess of NH_3 injury appears more readily than with an excess of nitrates. The acidity produced by the physiologically acid NH_4 salts plays a part in the process. Therefore nitrification is not a desirable process from the standpoint of plant nutrition, since less energy is expended in converting NH_3 into protein than nitrates. The nitrification process is so to speak a "hygienic" function: it regulates the concn. of NH_3 . By regulating the concn. of NH_3 and neutralizing the excess of acidity produced by the NH_4 salts it represents an excellent nutrient. J. S. JOFFE

Laboratory and field studies on green manuring under paddy-land (anaerobic) conditions. A. W. R. JOACHIM AND S. KANDIAH. *Trop. Agr. (Ceylon)* 72, 253-71 (1929).—When green manures are plowed under immediately before flooding rice land, large quantities of NH_3 become available to the crop. Max. ammonification is obtained in about 4 weeks and after the 6th or 7th week the soil NH_3 content falls off. When the green manure is turned under in a semi-dry soil several weeks before planting nitrates are formed in large quantity but are lost to the rice when the land is flooded. No nitrates are found in paddy soils after they have been puddled. If added they are quickly denitrified. Fertilizer N for wet land rice should not be in the form of nitrates. Large losses of total soil N occur from check and previously green manured paddy soils, but the N content may be maintained by green manuring just before planting and flooding. References are given.

A. L. MEHRING

The effect of potassium, nitrogen and phosphorus fertilizing upon the chloroplast pigments, upon the mineral content of the leaves, and upon production in crop plants. F. M. SCHERTZ. *Plant Physiology* 4, 269-79 (1929).—P, K and N may each be correlated with an effect on the formation of chloroplast pigments. N was correlated with an increase in the chloroplast pigments and also with an increase in the amt. of carotinoids. In potatoes the application of fertilizers high in K suppressed chloroplast pigment formation. The effects of the application of fertilizers high in N or in P or in K on the yields and also on the leaf content with respect to the fertilizing element supplied are discussed. The results from a fertilizer expt. at Arlington Farm are not in agreement with the results elsewhere.

WALTER THOMAS

Geographic net of experiments on liming in 1926 and 1927. A. P. LEVITZKII. *Trans. Sci. Inst. Fertilizers (Moscow)* No. 61, 22-7 (1929).—From a series of expts. with lime (4.5 tons per hectare), with and without stable manure, on soils of the podzol type and on transition soils located south of the zone of the podzols it was found that in general the crops benefited by liming. This was especially noted in the region of the podzolized soils. Results from stations showed beneficial residual effects, on crops following, which surpassed the beneficial effects on the crop which was originally limed. This was explained by the fact that the limestone being of a coarse nature reacted slowly.

J. S. JOFFE

The influence of liming on the chemical composition of the oat crop. F. T. PERITURIN. *Trans. Sci. Inst. Fertilizers (Moscow)* No. 45, 55-63 (1927).—Vegetation pot expts. with CaO as the source of lime in amts. of 0.03, 0.075, 0.3, 0.5 and 1.0% gave an increase in N content from 170.9 mg. on control to 448.1 mg. on the 0.5% treatment with intermediate increases for the other treatments. The P_2O_5 increased from 125.6 mg. to 245 mg.; the CaO increased from 69.2 mg. to 161.0 mg. The increase in yield of dry matter was from 17.87 mg. to 27.22 mg. The results are on the basis of the total crop. The increase in P_2O_5 content in the plants is due to the exchange of Ca in the Fe and Al phosphates.

J. S. JOFFE

The influence of lime in the process of phosphoric acid mobilization in the soil. O. K. KEDROV-ZIKHMAN. *Trans. Sci. Inst. Fertilizers (Moscow)* No. 61, 107-8 (1929).—Lime releases soil phosphates by virtue of forming org. P compds. which are easily attacked by microorganisms and thus made available. The Ca also replaces the Fe and Al from their resp. phosphates, giving a Ca phosphate which is available. Caustic lime is more effective in the mobilization of soil phosphates than limestone.

J. S. JOFFE

The influence of lime and raw phosphates on podzolized soil and crop yields. D. V. DRUZHININ. *Trans. Sci. Inst. Fertilizers (Moscow)* No. 45, 5-51 (In German 52-3) (1927).—Podzolized soils have a very low buffer activity, because of their low content of exchangeable bases. Liming these soils decreases their acidity and increases the nitrate content; the water-soluble P decreases, while the P content in the plants increases. For heavy soils an excess of lime above the amt. shown by the exchange acidity is necessary for the best results. For light soils no excess of lime is necessary. Raw phosphate does not change the active acidity, but it affects the nitrate formation and increases the yields. The active acidity of podzolized soils is equal to that reaction of water cultures at which P_2O_5 from raw phosphate becomes available to plants.

J. S. JOFFE

Field experiments with phosphate in 1927. A. N. LEBEDYANTSEV. *Trans. Sci. Inst. Fertilizers (Moscow)* No. 61, 5-21 (1929); cf. C. A. 23, 463. The relative efficiency of raw phosphates compared with superphosphate, with and without the other plant food ingredients, was tried out on different soils with a variety of crops on the exptl. fields of the expt. stations of the resp. regions. The raw phosphate was of 2 grades: one contg. 12.79% P_2O_5 ground to a fineness where 82% of the flour passed a 0.1-mm. sieve, the other contg. 16.8% P_2O_5 with 65% passing a sieve of 0.08 mm. and

even lower. The results of the expts. are presented in a series of tables and the conclusions are: (1) In the non-chnozem belt, or, more correctly, in the podzol zone, the raw phosphate on winter crops, in amts. equal, double or triple the quantity of superphosphate—the latter being applied in quantities of 45 kg. P_2O_5 per hectare gave just as good increases in yield as the superphosphate. No other plant foods were added. The spring crops received besides the phosphated also some of the other plant foods and the increase in yield was slightly greater than that with the phosphates alone. (2) On the chernozem soils the effect of raw phosphate was noted in the zone of degraded chernozem, decreasing in effectiveness as the chernozem was located more south or in the more dry regions, as around the Volga. Addns. of K and N fertilizers to the Southern chernozem impeded the slight effect of the phosphates. This was especially true with spring grains. J. S. JOFFE

Experiments with Solikamsk potassium salts in 1927. D. V. DRUZHININ. *Trans. Sci. Inst. Fertilizers* (Moscow) No. 61, 71-88 (1929).—The Solikamsk salts (mixture of KCl and NaCl) acted beneficially on sugar beets, barley, lupines and in some cases on flax, when the other fertilizing elements, N and P, were added. They compared favorably with the other forms of K salts, especially on sugar beets, barley and potatoes. The introduction of Ca in amts. equal to twice the exchange acidity of the soils gave good results. Acid soils with a high unsatn. (rich in H ions) were improved very slightly by K fertilizers. The depressing effects of the Solikamsk salts on flax could be traced to the high H-ion capacity of the soil, with a low base content. Also the large amt. of salts necessary to introduce in the form of the Solikamsk salt for the optimum K content increased the osmotic pressure of the soln. and impeded the growth of the flax. It thus becomes clear that podzol soils need liming alongside with the introduction of the K salts; otherwise the replaced H ions have a bad effect. J. S. JOFFE

Fertilizing by carbon dioxide. JAROSLAV HROMÁDKO. *Chem. Obzor* 4, 226-8 (1929).—Fertilizing methods and results obtained with CO_2 (used either directly or indirectly by decomn. of carbonaceous substances in soil) are described. The whole problem requires further scientific studies. JAROSLAV KLEČKA

Cyanamid, its uses as a fertilizer material. F. E. ALLISON. U. S. Dept. Agr., *Circ.* 64, 1-12 (1929).—This circular gives the main steps in the manu. of Cyanamid, discusses its phys. and chem. properties and describes in detail how it may be used to best advantage as a fertilizer material. W. H. ROSS

Molasses as a fertilizer. WM. W. G. MOIR. *Proc. Hawaiian Sugar Planters' Assoc.*, 48th Ann. Meeting 1928, 135-65 (1929).—The greatest effect from molasses applications is on the microorg. population of the soil and their resultant activity and changes in phys. and chem. soil structure. Molasses increases the water holding capacity of open sandy soils. The same fact seems to explain the detrimental effect of molasses on heavy soils, causing poor aeration which, together with the acids of the fermentation processes, creates a situation where soil Fe, Al and Mn salts impair plant growth. Applications of molasses have a marked effect in ultimately increasing the availability of the soil N, and also the availability of soil P and K. Many poor results obtained with molasses seem to be due to an unwise choice of soil type and to a lack of inorg. fertilizer elements, particularly P, in the soil itself. Application of molasses results in a temporary conversion of soil nitrate into insol. org. compds., but these are again converted into nitrates after the fermentation processes cease. Results of practical experiences in the use of molasses as a fertilizer are tabulated. K. D. JACON

A preliminary note on the effect of sodium silicate in increasing the yield of barley. R. A. FISHER. *J. Agr. Sci.* 19, 132-9 (1929).—Field expts. show that the addn. of Na silicate increases the yield of barley to a considerable extent, particularly when no superphosphate is added. The P_2O_5 content of the ash is not greatly increased in the grain and is diminished in one case in the straw. The conclusions from this observation that the silicate does not act by releasing soil P_2O_5 , but as a plant stimulus, overlooks the fact that the addn. of SiO_2 to the ash naturally reduces the % of other constituents, and should be discounted. The P_2O_5 removed annually in the crop is greatly increased on the plots receiving silicate, even when this removal has continued for many years without replacement. That addnl. P_2O_5 is actually made available to the crop on the plots receiving silicate is shown by the increase in the proportion of P_2O_5 in the dry wt. of the crop, which appears on all the plots, and at all periods. This increase is quantitatively sufficient to account for the increased yield in grain and straw, without postulating the aid of any stimulus to plant growth. P. R. DAWSON

Chemical and physico-chemical investigation of the chief brands of Paris greens. LOUIS A. DESHUSSES AND JEAN DESHUSSES. *Ann. Jals.* 22, 392-6 (1929).—The methods of analysis used are described and the results obtained with over 100 samples of French,

German and Swiss products are discussed. The following standard is proposed: total As_2O_3 not less than 55%, free As_2O_3 not over 0.5%, sol. As_2O_3 not over 3.5%, fineness (as detd. with the Chancel sulfurimeter) not less 30°, H_2O not over 2%. A. P.-C.

Investigations on the fungicidal action of sulfur. II. Progress report. B. T. P. BARKER. *Long Ashton Ann. Rept.* 1927, 72-80; cf. *C. A.* 16, 3522.—When S is dusted on actively growing leaves of certain plants, H_2S is given off. This gas is poisonous to fungi. **III. Studies on the toxicity of sulfuretted hydrogen and on the interaction of sulfur with fungi.** R. W. MARSH. *J. Pomology Hort. Sci.* 7, 237-50(1929).—Germination of the spores of fungi is completely inhibited by various concns. of H_2S gas in air as follows: *Botrytis cinerea* 1-8000, *Monilia cinerea* 1-40,000, *Monilia fructigena* 1-3000, *Fusicladium dendriticum* 1-4000, *Cladosporium herbarum* 1-4000, *Penicillium veridicatum* 1-8000 and *Physalospora myabeana* 1-8000. Concns. of 1 part H_2S in 2000 parts of air had no apparent effect on flowering strawberry plants. Spores of fungi placed near strawberry leaves dusted with S failed to germinate. Certain spores on germination interact with S to produce H_2S and are therefore self poisoning. References are given.

A. L. MEHRING

The action of certain chemical substances on the zoöspores of *Pseudoperonospora humuli* (Miy. et Takah.) Wils. W. GOODWIN, E. S. SALMON AND W. M. WARE. *J. Agr. Sci.* 19, 185-200(1929).—Expts show that both *Pseudoperonospora humuli* and *Phytophthora infestans* are extremely susceptible in the zoospore stage to the action of weak solns. of soap or saponin. The zoospores disintegrate suddenly, apparently by changes in surface tension, within 60 sec. in solns. contg. over 0.1% of soft soap. Those of *P. humuli* are more vulnerable than are those of *P. infestans*. The fungicidal action of soap and saponin mixed with certain adherent substances was tested on hop plants. The power of adhesion and the fungicidal efficiency of the mixes. were tested by allowing single drops to dry on the surface of watch glasses and by then adding drops of water contg. zoospores. Other substances, such as Al-lime mixt., glycerol, I and Br, also killed zoospores rapidly.

P. R. DAWSON

Investigations on the biology and the extermination of the Walang Kongkang. P. C. BOLLE AND L. STAMMESHAUS. *Arch. Suikerind. Mededeel. Proefsta. Java Suikerind.* III, 459-501(1929).

P. R. PEKELHARING

Investigations of the adaptability of wet treatments for the disinfection of the seed of cereal crops. FR. ZIMMERMANN. *Z. Pflanzenkrankh. Pflanzenschutz* 39, 209-34(1929).—From an extensive study of seed disinfection by using the commercially available dusts and chemicals for dip treatments, and making field tests on the treated seed, it is concluded that wet treatments are as good as dusts for the disinfection of rye, wheat and barley. With oats the wet treatments were not always as successful.

LAWRENCE P. MILLER

Studies of the permeability of plant cells in relation to mercury disinfection of seeds. ANNELESE NIERHAMMER. *Z. physik. Chem., Abt. A.* 142, 309-19(1929); cf. *C. A.* 23, 2506, 3006. Both seeds and seedlings of grains were treated with solns. or suspensions of various org. and inorg. compds. of Hg for periods varying from 1 hr. to several days. The walls of the seeds and roots act as semi permeable membranes, permitting the passage of some compds. but not others. Only faint traces of Hg were detected in the seeds. Appreciable amts. penetrated into the roots. The disinfectant prepn., *Uspulun*, *Germisan*, *Ostan* and *Kalimat*, penetrate into the roots rapidly in concns. of 0.0005 to 0.005%. Conclusion. Hg found in plants whose seeds have been disinfected with Hg prepn. has been taken up by the roots from the soil, rather than by the seeds directly.

C. T. SNELL

Investigations on chlorosis of fruit trees. IV. The control of lime-induced chlorosis in the field. T. WALLACE. *J. Pomology Hort. Sci.* 7, 251-69(1929); cf. *C. A.* 23, 5000. The action of $FeSO_4$ sprays in controlling chlorosis is uncertain and may result in damage. $Al_2(SO_4)_3$ has no effect on Ca induced chlorosis. Considerable control may be obtained by growing permanent cover crops over the root systems of the affected trees. References are appended.

A. L. MEHRING

The occurrence of chlorates in a tomato soil. O. OWEN. *J. Pomology Hort. Sci.* 7, 270-5(1929).—A soil in which tomatoes showed characteristic symptoms of malnutrition contains 0.02% $NaClO_3$ and 0.004% $NaIO_3$. This may have developed from the continued use of Chili saltpeter. Addn. of small quantities of $NaClO_3$ or $KClO_3$ to normal soils resulted in the appearance of identical symptoms. Steaming affected soil, restoring its usefulness for growing healthy tomatoes.

A. L. MEHRING

Reports on pathology. C. W. CARPENTER, J. P. MARTIN, C. C. BARNUM AND

D. M. WELLER. *Proc. Hawaiian Sugar Planters' Assoc., 48th Ann. Meeting 1928*, 331-49(1929); cf. *C. A.* 22, 3726.—The fungus *Pythium aphanidermatum* seems to be the primary cause of root rot in Lahaina cane. The fungus grows in pure culture in acid or alk. media, the tolerated range of H-ion concn. being comparable to that of Hawaiian soils. It grows readily at a temp. of 60°F., cool, wet weather being very favorable to its spread. In pot cultures it is controlled in some degree by applications of CuCO_3 or CuSO_4 . Lahaina cane is susceptible to root rot when over-supplied with nitrates or products of cane trash decompn. Eye spot disease of cane was best controlled by dusting with S contg. 1% of KMnO_4 . The treatment, however, did not show sufficient merit to warrant its trial on a large scale. Addn. of adhesive agents did not improve the efficiency of the dust. Susceptible varieties of cane tend to have a comparatively thin leaf cuticle when grown in high Ca soils and seem to be more susceptible to eye spot injury than the same varieties grown in soils high in Mg, K and Na; in the latter cases the tendency is toward the formation of a thick leaf cuticle which is more resistant to penetration by the eye spot fungus.

K. D. JACOB

Beet flies in 1928. O. KAUFMANN. *Zuckrübenbau* 6, 103(1929); *Listy Cukrovár. Rochledy* 47, 42.—The larvae of the flies were killed by a 6% soln. of BaCl_2 only to an extent of 48%; some damage to the plants was caused by the soln. Spraying with nicotine, nicotine sulfate and tobacco exts. were not applicable to the demands of large fields. Spraying with NaF was effective against the second generation.

F. M.

Chemical means of exterminating vegetation. N. ELMANOVICH. *Trans. State Inst. Applied Chem. (Moscow)* No. 8, 147-64(1927).—For exterminating grass along the railroad right of way solns. of As and Hg compds., ZnCl_2 , NaF, alkalis, chlorates, chromates, formalin, naphtheneic acid, etc., are most effective. In view of the considerable adsorption capacity of the soils, it is necessary to operate with not less than 25-100 g. soln. per sq. m. of surface; only an insignificant part of the chemical acts on the roots of the vegetation. Many of the chemicals used may compete, from the point of view of cost, with the usual method of grass elimination by manual work. The duration of action of various chemicals on the soil is very unequal, some of them, e. g. Na_2AsO_4 , rendered the ground unfertile during the whole period of observation.

B. N.

The character, properties, and possible uses of bentonite (WOODMAN, TAYLOR) 18. Agricultural research [on soils] in Scotland in 1928 (ANON.) 12. The world production of phosphate rock and superphosphate, 1905-1928 (GRAY) 18. The solubility of the phosphates of Ca in aqueous solutions of SO_2 (MEBANE, *et al.*) 2. The alkalinity and reaction of South Bohemian waters, particularly pond waters and their soils (STÉPHAN) 14. Organo-Hg compounds [fungicidal agents] (Brit. pat. 307,532) 17. Refining petroleum [to produce insecticide] (Fr. pat. 658,630) 22.

JACOB, ARTHUR AND KABITZSCH, ALBERT: *Die Gewinnung der Kalisalze und ihre Anwendung in der Landwirtschaft*. Berlin: Verlagsgesellschaft f. Ackerbau. 79 pp. M. 1.

LOCHOW, F. VON: *Die Bedeutung des Kalkes für die leichten Böden*. Berlin: Kalkverlag. 21 pp. M. 1.

Dichlorobenzene. BENEDETTO M. RIVETTI. Fr. 651,389, Mar. 12, 1928. A mixt. of "metilesaline" and potash soap is used for solubilizing or emulsifying *p*-dichlorobenzene for use as an antiparasite.

Fertilizers. I. G. FARBENIND A.-G. Brit. 307,230, March 30, 1928. Siliceous materials such as sand or quartz are heated with 1.5-8.0 times their wt. of H_3PO_4 to above 250° and the product may be treated with NH_3 and may be mixed with other fertilizers.

Fertilizers. W. J. WORBOYS and IMPERIAL CHEMICAL INDUSTRIES, LTD. Brit. 307,575, Jan. 9, 1928. Granular fertilizers are made by use of Fe phosphate or Al phosphate or other gelatinous phosphate as a binder. Various details and modifications are described.

Fertilizers. STOCKHOLMS SUPERFOSFAT FÄBRIKS AKTIEBOLAG. Fr. 658,554, Aug. 3, 1928. A fertilizer is produced by adding a soln. of a N-contg. salt and H_3PO_4 or potash to a mixt. of 2 or more acids, and introducing the finely divided mixt. into a vessel contg. gaseous NH_3 . Cf. *C. A.* 23, 5001.

Insecticides. ISAAC LÉVY. Fr. 658,491, Aug. 2, 1928. Chloropicrin is used for destroying vermin and disinfecting.

Colloidal compounds such as calcium arsenate. AUGUST CHWALA. U. S. 1,728,-

662, Sept. 17. Insol. salts of acids of the As group, e. g., Ca arsenate, are mechanically dispersed in the presence of alkali salts of "water poor acids of the As group" such as Na pyrophosphate. The products are suitable for use on plants.

Herbicide. RALPH N. CHIPMAN. Fr. 659,957, Sept. 4, 1928. A soln. of $\text{Ca}(\text{ClO}_2)_2$ or of NaClO_2 and CaCl_2 is used as a herbicide.

16—THE FERMENTATION INDUSTRIES

C. N. FREY

Comparative experiments on the influence of different concentrations of various alcohols on alcoholic fermentation. EMIL ABDERHALDEN. *Fermentforschung* 11, 86-91 (1929).—The influence of low concns. of various alcs. on the rate of glucose fermentation by yeast was detd. under as nearly uniform conditions as possible. Weighed quantities of yeast and glucose were added to 25 cc. of a phosphate soln. of pH 6, and the rate of fermentation was detd. with and without the addn. of alc. Fermentation was accelerated by 0.01-0.02 cc. MeOH , 0.01 cc. EtOH , 0.001 cc. PrOH and 0.001-0.0001 cc. Me_2COH ; it was retarded by 0.025 cc. EtOH . Little if any acceleration was produced by Me_2CHOH , BuOH , iso- BuOH , AmOH , iso- AmOH , hexyl alc., heptyl alc. and $\text{Ph-CH}_2\text{OH}$. Dried yeast showed practically the same response as fresh yeast, except that the accelerating effect where observed was obtained with lower concn. of the alc.

A. W. DOX

Determination of alcohol by chromic oxidation. Complementary note. L. SEMICHON AND M. FLANZY. *Ann. fals.* 22, 414-5 (1929); cf. C. A. 23, 3537.—In the review of previous method, the Lavalée-Boidin method (*Congrès de Chimie Appliquée, Rome, 1906*) was overlooked. It is similar to the Martin method (C. A. 20, 475) except that the hot alc. vapors are received in a special "caterpillar" absorption tube and distn. is carried out extremely slowly. The method is much longer and requires more delicate manipulation than S. and F.'s cold chromic oxidation method, but can give practically as accurate results.

A. PAPINEAU-COUTURE

Formation of *l*-malic acid from fumaric acid by *Aspergillus niger*. FREDERICK CHALLENGER AND LOUIS KLEIN. *J. Chem. Soc.* 1929, 1614-7.—The fermentation of K fumarate by *A. niger* gives rise to *l*-malic acid, characterized by several independent methods, the yield is about 40% after 12 days. Since the mold preferentially assimilates the *l* acid, the formation of *l*-malic acid must occur by asymm. addn. of H_2O to the double linking. Unpublished work by Walker shows that the reaction is reversible.

C. J. WEST

Use of capillary analysis for liquors and distillates. M. B. SHVARTZMAN. *Farm. Zhur.* 1929, 326-8.

J. KUČERA

Chemical composition and taste properties of spirits from agricultural distilleries. T. CHRZĄSZCZ, A. KŁODNICKI AND J. SUCHODOLSKI. *Przemysł Chem.* 13, 257-68 (1929).

—The research covering 48 distilleries is concerned with the design of the app., raw materials, malt, water and mash. Chem. compn., taste and aroma of the spirit do not depend on the material of construction of app. In that respect Fe is as good as Cu. Continuous systems in general produce spirit of better quality than the periodic, but no distinction is found between one- and two-column devices. Strength as high as 92° Tr. favors good quality, and that below 88° Tr. is usually accompanied by low-grade product. Fermenting vats of smooth surface are advantageous because they avoid colonization of detrimental organisms. For this reason covered Fe vats are good. Potatoes which are rotten or damaged in any such way as will produce rotting give spirit of very bad taste. Bad fermentation of mash or strong infection result in bad taste. Evolution of H_2S from the mash indicates a poor spirit. A large amt. of acid in the mash does not necessarily raise the acidity, as these values are not interrelated. The acid in the mash can be expressed in pH of the spirit, but not as might be expected from the degree of its infection. Acid, aldehyde and ether contents of the spirit show no relationship to its taste, but great fusel oil content, and a rapid rate of reduction of KMnO_4 stand in direct relation to bad taste.

A. C. ZACHLIN

Determination of reducing sugars in brewing liquids. ALOIS STADNIK. *Chem. Obzor* 4, 216-8, 248-51 (251 English) (1929).—Iodometric methods for detn. of reducing sugars (calcd. as maltose) and dextrins based on their oxidation by hypoiodite were worked out. The analytical error due to the similarity in the behavior of dextrins and of maltose is smaller in worts than in beers. In the completely fermented liquids (beer) the dextrin quality approaches that of achroodextrin II; it is possible to det. dextrins

there by multiplying the quantity of dextrose found by 4. The methods can be applied to the routine analyses of malts and beers. JAROSLAV KUČERA

Protein of different barleys and turbidities produced by pasteurization. W. HESSELBERGER. *Wochschr. Bran.* **46**, 285-8(1929).—The appearance of turbidity in beer, as the result of pasteurization, can be prevented by treatment of the beer with suitable adsorbent substances, which remove the nitrogenous matters responsible for the turbidity. Analysis of the nitrogenous matters of various typical barleys, and the beers prepd. from them, showed that there are wide differences in the relative amts. of the different forms of N in the hydrolytic products. These results indicate the insufficiency of a mere detn. of total N in barley, as a means of judging its brewing characters. S. J.

Drying malt in thick layers. J. STEENBERGHE. *Bull. trimestr. assoc. élèves école sup. brasserie univ. Louvain* **29**, 61-6(1929).—A brief description of drying towers of small cross-sectional area in which the malt is dried in thick layers, with a discussion of their operation and control. A. PAPINEAU-COUTURE

Modern malting processes. G. CHAROT. *Bull. assoc. élèves inst. sup. fermentations Gand* **30**, 17-26(1929); cf. *C. A.* **23**, 4528.—An address reviewing the evolution of chem. and biochem. processes in the malting industry. A. P.-C.

Determination of copper in musts and wines. G. DEBORDES. *Ann. fals.* **22**, 410-4(1929).—All reagents must be Cu-free. Take a vol. of sample contg. 0.25-2.0 mg. Cu, bring to 200-300 cc., drive off SO_2 if necessary, add 5-10% concd. H_2SO_4 and 0.1-0.2 g. HgCl_2 , heat to boiling, remove the flame, pass in H_2S till the soln. is cold, filter through paper using a Pt cone and moderate suction, wash with 4% AcOH satd. with H_2S , calcine in a quartz crucible, take up in 10-5 drops of 1:1 HNO_3 : H_2SO_4 mixt., transfer to the electrolyzing vessel with sufficient H_2O to make a total vol. of not over 5 cc., electrolyze in the cold with about 0.2 amp. under 2-2.2 v. for 30 min., wash with about 150-200 cc. H_2O , taking care to keep the current on till all the soln. has been removed, without removing the anode add 5 cc. of Pontès and Thivolle's phosphomolybdic reagent (*C. A.* **20**, 350), transfer the deep blue soln. to a large test tube and titrate with standard KMnO_4 (0.8% KMnO_4 dild. 100 times immediately before use). Standardize the KMnO_4 soln. against 2 cc. of 0.1964% $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (1 cc. = 0.0005 g. Cu) which is electrolyzed and treated as above; the titration should require 8-12 cc. If the instructions are strictly followed there is no oxidation of the blue compd. within a reasonable time (up to 1 hr.) and the KMnO_4 required is strictly proportional to the Cu content. If the H_3PO_4 is used at too high a concn. for the prepn. of the phosphomolybdic reagent, the blue compd. is spontaneously oxidizable in presence of air. A. P.-C.

The iron content of wines of the Hérault (France). E. HIGUES. *Ann. fals.* **22**, 407-10(1929).—Wort from various kinds of grapes contained less than 1 to 4.5 mg. total Fe per l., and Fe appears in appreciable quantity (over 1 mg.) in the grapes only when they begin to ripen. The wines prepd. from these musts in the lab. in glassware had practically the same Fe contents as the resp. musts. The nature of the soil on which the grapes were grown apparently exerted no influence on the Fe content. Wines made commercially from the same species of grapes contained 5-39 mg. Fe per l., showing that by far the greatest portion of the Fe contained in wines comes from the Fe or concrete equipment used in wine-making. A. PAPINEAU-COUTURE

The detection of coal-tar dyes in red wines. D. MAROTTA. *Ann. chim. applicata* **19**, 148-64(1929).—Six common methods recommended for detection of dyes in wines have been tested: (1) fixation of the color on wool in acid soln.; (2) fixation of the color on wool in alk. soln.; (3) formation of lakes with yellow HgO ; (4) as in 3 with addn. of K_2CO_3 ; (5) extn. with $\text{C}_2\text{H}_5\text{OH}$ in alk. soln.; (6) formation of lakes with basic lead acetate and extn. with $\text{C}_2\text{H}_5\text{OH}$. Only method (1) for acid coloring materials, and (5) for basic coloring materials were strictly accurate. A. W. CONTIERI

The determination of volatile acids in wine. D. COSTA. *Ann. chim. applicata* **19**, 189-213(1929).—In order to get a true measure of the volatile acids in wine (HOAc) it is necessary to use at least 50 cc. and distil with steam till 300 cc. distillate is collected. To exhaust the acid most rapidly 50 cc. should be concd. to 25 cc. and the distn. continued maintaining this const. vol. A. W. CONTIERI

Physical and biological studies on the dextrorotatory sterol of beer yeast. R. FABRE AND H. SIMONNET. *Compt. rend.* **188**, 1312-5(1929).—Light absorption curves are given for zymosterol. They show much lower ultra-violet absorption than ergosterol. Irradiation with ultra-violet light caused no change in the absorption curve. Biological tests on white rats showed that dextrorotatory sterol was about 100 times less effective than ergosterol. The effectiveness is not entirely lost by exposure to ultra-violet light under the conditions noted. J. G. McNALLY

Production of dry pitching yeast of high fermentative power. F. WINDISCH.

Wochschr. Brau. **46**, 288-91(1929).—Two bottom-fermentation beer yeasts (U and D) were strongly pressed and then dried in 3 different ways: at 33° for 2 days; at 20-22° for 3 days; at 2° in a desiccator. Conclusion: Rapid drying of yeast in the warm (33°) injures the biological character less than slower drying at the ordinary temp., probably because autolytic changes can proceed farther under the latter than the former conditions. If, however, the drying is carried out at a very low temp. autolysis is minimized and a dried product suitable for pitching is obtained. Such a method of drying may prove very useful for yeasts which have to be transported. It is thus possible that the nutritive value of brewery waste yeast employed as fodder might be greatly enhanced by a process of cold desiccation. S. Józsa

Citric acid [preparation by fermentation of sugars] (Dyson) **10**. A manometric method for the determination of gas in fermentations (RAYMOND) **11B**. The proteolytic enzymes in malt (LÜBERS, MALSCH) **11A**. Growth of yeasts and molds at the expense of NH_3 and alcohol vapors (LINDNER) **11D**. Moldable compositions containing powdered metals [for brewing vessels or pipes] (Brit. pat. 307,011) **18**.

Use of peroxidized compounds to stimulate fermentations. JOHANNES VAN LOON (to Novadel-Agenc Corp.) U. S. 1,727,223, Sept. 3. Benzoyl peroxide, dibenzal diperoxide or other peroxides or persalts (either org. or inorg.) are used to stimulate fermentations induced by yeast, *Aspergillus niger*, yoghurt ferment or other fermentation-inducing organisms.

Alcohol. LUCIEN M. J. BERNARD. Fr. 659,231, Dec. 12, 1927. Waste fractions from the rectification of brandy are saponified with NaOH and rectified to produce an alc. of good taste.

Lactates. SANFORD K. ROBINSON (to K.-P. C. Co.). U. S. 1,726,768, Sept. 3. Whey is fermented to produce lactic acid in soln., the soln. is treated with an alkali such as NaOH to produce the desired lactate, the soln. is evapd. to ppt. undesired salts and the ppt. is removed.

Filtration of wine lees, etc. JULES GRAS. Fr. 659,868, Dec. 22, 1927. Liquids contg. colloidal materials, particularly wine lees, are treated with gaseous Cl to facilitate filtration or decantation.

Yeast. JOHN R. WHITE (one-half to Henry Leeds). U. S. 1,727,847, Sept. 10. Yeast is propagated in a series of sacchariferous solns. contg. small proportions of salts such as NaCl, KBrO₃ or other salts which are used in dough, in order to acclimatize the yeast to these salts.

17 PHARMACEUTICAL CHEMISTRY

W. O. EMERY

New reaction of hydrastine and of papaverine. C. A. ROJAHN AND F. STRUFFMANN. Univ. Halle-Wittenberg. *Pharm. Zentralhalle* **70**, 277(1929).—The sample is mixed with a very small quantity of papaverine or hydrastine, resp., on a watch glass and then treated with 3 drops of Frohde's, Mandelin's or Mecke's reagent, where upon a blue-violet to deep blue color develops, while with hydrastine alone only a dirty brown color appears, and papaverine only after long standing or warming develops a faint violet color. W. O. E.

Purification and preservation of ether for anesthetic use. S. PALKIN AND H. R. WATKINS. *Ind. Eng. Chem.* **21**, 863 7(1929). Ether, even when specially purified and kept in a dark, cool place and access of air prevented, shows a marked tendency to develop CH_3CHO and H_2O_2 . Ether may be preserved by keeping over pyrogallol or permanganate fixed in very concd. alkali and spread over asbestos, and may be purified by distg. over the same material. E. G. R. ARDAGH

The nature of the sugars contained in the root of *Glycyrrhiza glabra*. A. GIAMMONA. *Ann. chim. applicata* **19**, 110 27(1929). Freshly dug roots of licorice contain glucose 1.38% and sucrose 3.18%, after 3 months' drying in air these values are 2.37% and 5.40%, resp. No fructose and, therefore, no invert sugar is present. A. W. C.

Microchemical reactions for coniine. M. WAGENAAR. *Pharm. Weekblad* **66**, 757-60(1929).—The delicacy of various reactions was detd. in terms of min. concn. and min. quantity of alkaloid detectable: (1) CdI_2 , 1:100, 0.025 mg.; (2) PtCl_4 + NaI, 1:100, 0.005 mg.; (3) alkali chlorides and bromides, 1:100, 0.002 mg.; (4) $\text{K}_4\text{Fe}(\text{CN})_6$, 1:100, 0.01 mg.; (5) phosphomolybdic acid, 1:5000, 0.0001 mg.; (6) K Bi iodide,

1:1000, 0.0005 mg.; (7) K Sb iodide, 1:100, 0.001 mg.; (8) tetrachloroquinone, 1:100, 0.002 mg. The $C_6Cl_4O_2$ reaction in C_6H_6 is the most characteristic for coniine.

A. W. DOX

Determination of total geraniol in oil of citronella. J. ZIMMERMANN. *Chem. Weekblad* 26, 389-91 (1929).—The customary method, acetylation and subsequent sapon., gives high results with impure Ac_2O . Traces of H_2O and H_2SO_4 (not HCl), catalyze enolization and therefore diacetylation. The concn. of NaOH also influences results. Useful figures, within $\pm 2\%$, may be obtained if NaOH consumed by the original oil sample before acetylation is discounted.

K. H. ENGEL

Nerol and farnesol in cyclamen oil. F. ELZE. *Reichstoffind.* 3, 91; *Chem. Zentr.* 1928, II, 499; cf. *C. A.* 22, 2436.—After maceration, cyclamen flowers were extd. with liquid fat and steam distd. The oil was a pure yellow, inactive substance, $d_{15} 0.94467$, which contained ketones, aldehydes, phenols, esters and free alcs. Nerol was obtained from cyclamen oil, $d_{15} 0.880$, *diphenylurethan*, f. p. 50-50.5° and also farnesol, $d_{15} 0.895$, b. 145.6°.

C. R. FELLERS

Observations on insulin. I. Chemical observations. CHARLES R. HARRINGTON AND DAVID A. SCOTT. II. **Physiological assay.** KATHLEEN CULHANE, HENRY P. MARKS, DAVID A. SCOTT AND JOHN WM. TREVAN. *Biochem. J.* 23, 384-409 (1929).—Cryst. insulin, obtained by Abel's method (*C. A.* 20, 1494) and by a modification of this method was assayed physiol. by a no. of independent workers. The activity shown by the 4 samples assayed in comparison with the International Standard, and based on the av. of the values obtained by the 4 investigators, for each sample, may be assessed at 23.3, with a standard deviation for the mean of ± 0.6 . The uniform activity of the 4 batches of crystals seems to indicate that their substance has a closer relation to the specific insulin activity than that of an inert absorbent of an intensely active contaminant. On the other hand, the activity of the crystals is little, if at all, different from that of the most active amorphous insulin.

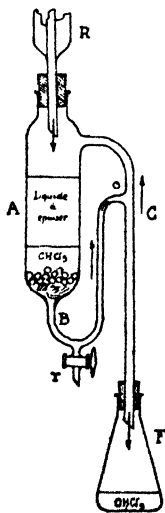
BENJAMIN HARROW

Lead tetrachloride as a reagent for alkaloids and the microchemical identification of cocaine and strychnine. V. ARREGUINE AND F. AMADEO. *Semana méd.* (Buenos Aires) 36, 645-7 (1929).—For the prepn. of $PbCl_4$ soln. ppt. $PbCl_4$ with HCl from a Pb salt soln., wash with H_2O , add HCl and $KClO_3$ until all is dissolved. The reagent ppts. many alkaloids; the ppt. with cocaine can be obtained from soln. 1:2000 and that with strychnine from soln. 1:3000. Both give characteristic microscopic crystals.

A. E. MEYER

A clinical method for standardizing insulin preparations. KARL CSÉPAI AND BÉLA FÖRSTNER. *Endokrinologie* 3, 412-6 (1929).—An intravenous injection of $\frac{1}{15}$ unit per kg. produces in normal individuals a definite series of changes in the blood sugar concn. The curves obtained with the tested prepn. are compared with those obtained on the same subject with a standard insulin prepn. (International or E. Lilly). S. MORGULIS

Chemical analysis facilitated by laboratory appliances: applications to the determination of theobromine and to the testing of cola preparations. JALABE. *Ann. fols* 22, 396-405 (1929).—The "perforator" illustrated herewith is



suitable for continuous extn. with a small vol. of a solvent (e. g., $CHCl_3$) heavier than the soln. to be extd., the extd. substance being weighed directly in the flask after evapn. of the solvent. The tube *B* should be of small bore to prevent siphoning. Its advantages for the detn. of theobromine in cacao and for the analysis of cola nuts and prepn.s are discussed.

A. PAPINEAU-COUTURE

Spectrographic study of alkaloids of Japanese menispermaceae.

E. OCHIAI. *J. Pharm. Soc. Japan* 49, 425-37 (1929). By using the quartz spectrograph (type E₂) of Adam Hilger absorption curves according to Hartley and Baly were plotted for the following compds.: (I) derivs. of sinomenine (cf. *J. Pharm. Soc. Japan* No. 538, 1008), (II) sinomenine, methylsinomenine and diversine, (III) epistephanine and isoeptephanine (cf. Kondo and Sanada, *C. A.* 23, 2978), (IV) cocaaurine and dauricine (*C. A.* 23, 2979), (V) tetranlrine (*C. A.* 23, 4475), (VI) trilobine and homotrilobine (*C. A.* 23, 392), (VII) insularine and (VIII) protostephanine. The results of the study are illustrated by means of 12 curves and the structure of each compd. is discussed.

F. I. NAKAMURA

A few artificial flower odors. OTTO GERHARDT. *Parfumerie moderne* 22, 547-59 (1929).—In French and English. Formulas are given and discussed for the production of lilac, gardenia, honeysuckle, broom, heliotrope and hyacinth perfumes.

A. P.-C.

The transformation of essential oils in plants. V. NYLOV, W. W. WILLIAMS AND L. A. MICHELSON. *Parfumerie moderne* 22, 567, 569(1929).—From a study of the changes in the analytical constns. of oils of *Coriandrum sativum*, *Foeniculum officinale*, *Juniperus excelsa*, *Rosmarinus officinalis*, *Hyssopus officinalis*, *Salvia officinalis* and *Lavandula spica* obtained at various stages in the development of the plants, it is concluded that the essential oil is subjected in the plant to gradual and regular transformations, on which external factors (such as moisture, fertilizers, character of the soil) have no effect as regards direction and general trend but can possibly exert a slight retarding or accelerating effect. The modifications in the compn. of the oils are directly related to the changes in the state of development of the plants; in many cases it is undoubtedly due to an oxidation process, which reaches max. intensity at the time of blossoming and of the appearance of the fruit. Even in those cases where there is an increase in the hydrocarbon content of the oil, it is considered highly unlikely that reduction phenomena take place but rather that the oxidation which takes place in certain cases converts some of the constituents of the oil into non-volatile, resinous substances, so that the amt. of hydrocarbons is increased when the products are steam-distd. A. P.-C.

Production of tablets. A. KUFFERATH. *Chem.-Tech. Rundschau* 44, 859, 923, 1017(1929).—A discussion of the modern tablet-pressing machinery, recent German patents and prepn. of the granulations, with information on suitable fillers and lubricants for various tablets. E. PICKERING

Camomiles and camomile oil (with special regard to the Hungarian camomiles). HANS KAISER, KARL JEGGENSPERGER AND HILDEGARD BÄRMANN. *Süddeut. Apoth.-Ztg.* 68, 284-7; *Chem. Zentr.* 1928, II, 1234.—German and Hungarian camomiles were examd. for their content of ethereal oil. The former contain twice as much as do the latter ones. The specifications of the German Pharm. 6 requiring 0.4% of ethereal oil for German camomiles are not too high. It is improper to screen the camomiles frequently because the tubular flowers with a high content of ethereal oil are removed by this process. G. SCHWOCH

Olive oil. C. EDWARD SAGE. *Chemist and Druggist* 110, 609(1929).—A plea for increased precision in the coming Brit. Pharm. in defining olive oil so as to exclude inferior grades, e. g., "treated oils" (neutralized rancid oils) or "extd. oils" (refuse pulp extd. with CS_2), etc. S. WALDBOTT

Nomenclature of liquid medicinal preparations. E. SCHLUMPF. *Pharm. Acta Helv.* 4, 1-15(1929).—To bring about uniformity in international pharmacopoeial nomenclature of medicinal preps., tentative definitions are suggested for each of the following classes of preps.: Aquae aromaticae, spiritus, solutiones, injectiones, liquores, emulsiones, suspensiones, linimenta, decocta, infusa, maccrata, lotiones, elixiria, misturae (= potiones) tincturae, succi. S. WALDBOTT

Determination of glycyrrhizic acid in radix and succus liquiritiae. R. EDER AND ANNA SACK. *Pharm. Acta Helv.* 4, 23-48(1929); cf. Tschirch and Ericsson, *C. A.* 5, 2413; Houseman, *C. A.* 15, 2959; Linz, *C. A.* 11, 2131; T. and Cederberg, *C. A.* 2, 1280; Peyer, *C. A.* 19, 3144; C. A. 21, 3104.—Preceding methods for the detn. of glycyrrhizic acid ($C_{42}H_{60}O_{15}$) (A) (structure: cf. *C. A.* 3, 1758; 15, 2427) are critically reviewed and a new and accurate method is worked out. Its successive steps are: (1) The complete extn. of A from the root with 50% alc. in a HCl medium, Bartolo's color tests for A (*C. A.* 20, 3458) being applied to the successive exts.; the weaker alc. leaves the bulk of the resin undissolved. (2) The quant. pptn. of A by addn. of a satd. soln. of neutral $Pb(OAc)_2$ which seps. A from sucrose, dextrose, mannitol and gum. (3) Distn. of furfural (C) from this ppt. on heating it with 12% HCl in an oil bath at 155° according to the technic of Steenberg (C. A. 12, 1896). (4) Pptn. of C either with phloroglucinol (Krocher 1900; Klingstedt C. A. 19, 2465), or as in this method, with *barbituric acid* (Unger and Jaeger, *Ber.* 36, 1222(1903); Dox and Plaisance, *C. A.* 10, 2751). After 16 hrs. standing, filter, dry and weigh the yellow compd. $C_4H_4N_2O_4$ (B). From pure A, E. and S. empirically obtained 13.75% B = 6.4% C to be used as equivalents for calcn. of A in com. samples. Air-dry Russian root, peeled, gave (1): 8.3% H_2O and 7.7-7.8% A; (2) 9.8% H_2O and 14.2-14.4% A. Spanish root, unpeeled, gave 9.7% H_2O and 7.9% A. To det. A in *succus liquiritiae*, use the method of Linz for extn. but also add HCl; after filtering, ppt. with $Pb(OAc)_2$ and proceed as with the root. "Cassano" licorice gave 11.8 and 12.5% A; *succus liquiritiae solutus*, Pharm. Helv. gave resp., 5.9-6.0 and 7.1-7.2% A. An attempt to det. A by detg. the equiv. quantity of CO_2 formed simultaneously with furfural, was successful only with pure A; with licorice root, much larger quantities of CO_2 were set free, probably caused by the oxalate content of the root. S. WALDBOTT

Valerian, its history, constituents and uses. JAMES GRIER. *Pharm. J.* 122,

302-4, 312-3; *Chemist and Druggist* 110, 420-2(1929); cf. *C. A.* 7, 2801.—A detailed review, including the history and pharmacognosy of valcrican, its pharmacy (Smodlaka, *C. A.* 16, 1126) and detn. of its oleoresin (Bullock, *C. A.* 18, 3449, 3451; 19, 3565).

S. WALDBOTT

Isotonic solutions. H. TREVES BROWN. *Pharm. J.* 122, 324(1929).—The definition of isotonic solns. for ophthalmic use and for injections is given. The calcs. involved in substituting the solute of an isotonic soln. by another substance are shown in the prepn. of different typical isotonic solns.

S. WALDBOTT

Some notes on gentian. H. STANLEY REDGROVE. *Pharm. J.* 122, 374-6(1929).—The botanical characters of gentian species of the British isles are compared, and a detailed description of the official *Gentiana lutea*, is given, with sketch. The therapeutic properties of the root and its ancient medicinal uses are discussed, and a review of its chem. constituents is given with the structural formula of gentisin (Shinoda, *C. A.* 21, 2270), a yellow pigment, physiologically inactive.

S. WALDBOTT

The physical and chemical analysis of glass and rubber used in the (British Navy) medical services. F. LEWIS SMITH AND F. HOOPER. *Pharm. J.* 122, 467-40(1929).—An address. Durability tests on samples of glass tubing to be used for ampoules are described in detail. The international adoption of a mark on medicinal glassware as guarantee of quality is advocated. The different factors entering into the deterioration of soft vulcanized rubber goods with age are discussed, and phys., chem. and heat tests are described (cf. *C. A.* 15, 3567; 17, 2975, etc.). At the British Navy, the general phys. condition of the rubber is tested before and after the following treatment: Boil in H_2O for 15 min., heat in autoclave for 20 min. at 15 lb. pressure, then apply dry heat resp. at 80° and 100° for several days and follow with immersion in alc., acetone, Et_2O and 5% soln. of $PhOH$.

S. WALDBOTT

Note on prepared chalk. J. H. FRANKLIN. *Pharm. J.* 122, 522(1929). The Brit. Pharm. requirements as to the limits of SiO_2 are very vague. Four com. lots exam'd yielded 1.096-1.280% of matter insol. in HCl . The U. S. P. allows 2% insol. in HCl , which test should be adopted by the Brit. Pharm.

S. WALDBOTT

Pharmacopeia revision notes. J. H. FRANKLIN. *Pharm. J.* 122, 569-70(1929); cf. *C. A.* 21, 1522.—For better consistency of *confectio senneae*, make the total wt. 10-15%, higher than in Brit. Pharm.; also add a preservative to prevent fungus growth. To prep. *extractum belladonnae liquidum* (cf. *C. A.* 22, 2032), collect 200 instead of 150 fluid ounces of percolate from 200 ounces of root ext'd., so as to enable the less experienced in percolation to obtain complete extn. In *liquor ferri persulfatis*, an upper and a lower limit for Fe should be fixed, in place of the inflexible single requirement of the Brit. Pharm. In *succus limonis*, 360 p. p. m. SO_2 or 600 p. p. m. $BzOH$ should be allowed as preservatives. In prep. *scrupus toluatus*, the "tolu liquor" should be made up to only about 360 cc. instead of 400 cc. if 1000 g. (Brit. Pharm.) is to be obtained (cf. Goldby, *C. A.* 9, 3327). In the prepn. of *tinctura ben ovi composita*, the stickiness of the ingredients compels extending maceration beyond 2 days. *Unguentum plumbi subacetatis* should contain at most 5% (not 12.5-7.5%) of hard paraffin, replace the rest with soft paraffin.

S. WALDBOTT

Some notes on cinnamon. H. STANLEY REDGROVE. *Pharm. J.* 123, 167(1929).—The botanical and com. history of cinnamon, its cultivation, medicinal and other uses, and the chem. character of its essential oil are discussed. Five references are added.

S. WALDBOTT

Red quebracho bark. E. M. HOLMES. *Pharm. J.* 123, 194-6(1929); cf. *C. A.* Reply to Short (cf. *C. A.* 20, 969).—Information received from Argentina induces H. to uphold his view that the tree which yields the rose colored bark belongs to a type of *Aspidosperma quebracho* as yet undescribed as a distinct form or variety; it is most likely identical with *Aspidosperma quebracho blanco*, var. *pendula* Spreng.

S. W.

Pharmacy in Germany. J. R. BOWDEN. *Pharm. J.* 123, 215-6(1929).—The pharmaceutical curriculum and the practical status of pharmacy in Germany are briefly compared with those of England.

S. WALDBOTT

The assay of extractum cinchonae liquidum. W. A. N. MARKWELL AND L. J. WALKER. *Pharm. J.* 123, 230(1929).—To 10 cc. of the liquid ext. in a 200-cc. Erlenmeyer flask add 10 cc. H_2O and 1.5 cc. HCl . Heat on the water bath for 30 min., cool and add 10 cc. of 15% $NaOH$ soln. Shake and add 100 cc. of a 3:1 mixt. of Et_2O and $CHCl_3$. Read the vol., note the temp., stopper securely and shake for 30 min. Add 1.5 g. powd. tragacanth and again shake. Measure off 50 cc. of the clear liquid at the same temp. as read before, running it into a sepg. funnel, and ext. the alkaloids successively with 10, 5, 3, 2, 1 cc. $NHCl$, the vols. < 10 being previously made up to 10 cc. with H_2O . Render the mixed acid solns. alk. with NH_4OH and ext. with successive

portions of 10 cc. CHCl_3 ; filter into a tared "Brewis" flask and distil off the CHCl_3 ; dry the residue to const. wt. at 110° . The method is more rapid than the Brit. Pharm. process, yields a cleaner sepn. of the immiscible solvents, and the results agree with those obtained by the Brit. Pharm. process. When the method is applied to the bark and the liquid ext. prepd. from it, the results are comparable.

S. WALDBOTT

Pharmacy in Malta. C. W. CATHY. *Pharm. J.* 123, 232(1929).—Descriptive of the theoretical prepn. required and the practice of pharmacy in the island. S. W.

Ergot and ergot extract. L. VAN ITALLIE AND FRL. HARMSMA. *Schweiz. Apoth. Ztg.* 66, 423-5(1928); cf. C. A. 11, 2531; 15, 923; 16, 2386, 2961, 3171; 17, 2010.—An address. In addn. to chem. and biol. methods of testing ergot, the absorption spectra of the 4 ergot alkaloids in ultra-violet light were studied, and absorption curves based on concn. of the alkaloids were obtained by Hartley's method. The curves differ very little from each other, indicating a close relationship between the alkaloids. The spectroscopic method checking the tartaric acid process of prepg. fluidext. of ergot in the Netherlands Pharm. showed only incomplete extn. of alkaloids. A well kept ergot is more stable than the fluidext., which may deteriorate in alkaloidal content by 50% in 6 months. Further studies should decide whether 1 of the 4 alkaloids may not replace the fluidext. or even the whole drug.

S. WALDBOTT

Oleum eucalypti globuli. J. LANG. *Schweiz. Apoth. Ztg.* 66, 601-3(1928).—A sample offered in the Swiss market examd. according to the requirements of the pending Pharm. Helv. V, had a weak odor of cineole, low sp. gr., high optical rotation, gave a neg. test with H_3PO_4 , and a faint 1 addn. test. It probably contained a small % of eucalyptus oil dild. with oils poor in cineole, or with oil of turpentine. S. WALDBOTT

Tests for MeOH (LEFFMANN, PINES) 7. The manufacture of medical cotton (NEUBERGER) 25. Ag in chemistry and pharmacy (DYSON) 2. Hg in chemistry and pharmacy (DYSON) 2. Ra (HINDS) 3. Lactucarium (BAUER, SCHUB) 10. Cu ammine complex azo compounds [inscetics] (Brit. pat. 306,859) 25. [Antiseptic soaps] (Fr. pat. 658,520) 18. Apparatus for the production of Cl (for therapeutic inhalation) (U. S. pat. 1,729,043) 18. Sterilizing vaccines, etc. (U. S. pat. 1,728,333) 12. Nuclear substitution products of 1-aminonaphthalene-8-carboxylic acid or its inner anhydride [pharmaceutical compounds] (U. S. pat. 1,728,965) 10. Electric chemical vaporizer for generating medicinal vapors (U. S. pat. 1,728,885) 4.

BLAS Y MANADA. **El indispensable al farmacéutico.** 3rd ed. Madrid: Imprenta de Estanislao Maestro. 163 pp. Ptas 15. Reviewed in *Chimie & industrie* 22, 225, *Pharm. J.* 123, 254(1929).

MOSBACHER, E. **Die neuesten Arzneimittel.** Berlin: Max Gerstmann. 56 pp. Reviewed in *Chimie & industrie* 22, 433(1929).

RODIER, J. **La lavande.** Paris: Revue des Marques. F. 20. Reviewed in *Parfumerie moderne* 22, 595, 597(1929).

Amino alcohols for pharmaceutical use. I. G. FARBENIND. A. G. Brit. 307,307, March 2, 1928. Yellowish oily products of high b. p., forming water-sol. salts with inorg. acids, are produced by reaction of the ethyl ester of diethylaminoethyl-4-aminobenzoic acid with PhMgBr , by reaction of the diethylaminoethyl ether of 2-hydroxybenzoic acid ethyl ester with the Grignard reagent from 4-bromophenol, by reaction of the methylaminoacetic acid ethyl ester with the Grignard reagent from 4-bromoanisole, and by other similar reactions.

Amino alcohols (pharmaceutical products). I. G. FARBENIND. A. G. Brit. 307,304, March 2, 1928. Amino alcs. which are yellowish viscous oils forming water-sol. cryst. salts with acids are formed by treating compds. such as diethylaminoacetone, 3-diethylamino-2-butanone, 3-tetrahydroquinonyl-2-propanone, 3,4-diethoxy-1- β -piperidinoacetophenone, N-diethylaminoethylmethylaminobenaldehyde, 4-diethylaminoethylaminoacetophenone, the diethylaminoethyl ether of 2-hydroxybenzaldehyde (or its 3 allyl deriv.), ω -diethylaminoacetophenone, ω -methylaminoacetophenone or aminoacetone with a Grignard reagent of the general formula Y.Mg.R in which Y represents halogen and R represents an alkyl, aryl, aralkyl, hydroaromatic or heterocyclic residue.

Therapeutic double compounds of 5,5-disubstituted barbituric acids with 6,8-dihydroxyquinoline ethers. I. G. FARBENIND. A. G. Brit. 306,905, Feb. 27, 1928. Examples are given of the interaction, in aq. soln., of Na 5,5-phenylethylbarbiturate with 6,8-diethoxyquinoline HCl and of Na cyclohexenylethylbarbiturate with 6,8-dimethoxyquinoline-HCl.

Vanadium derivatives of organic arsenic compounds. J. SCHUMACHER. Brit. 306,847, Feb. 24, 1928. *Therapeutic compds.* may be prepd. by reactions such as the treatment of 4,4'-dihydroxy-3,3'-diaminoarsenobenzene or its Na salt with Na orthovanadate or NH_4 metavanadate. Other examples also are given.

Organo-mercury compounds. I. G. FARBENIND. A.-G. Brit. 307,532, Dec. 8, 1927. Hydroxy compds. contg. Hg in the nucleus are obtained by the reaction of thiocyanic, ferrocyanic or ferricyanic compds. upon the hydroxy-Hg compds. or by mercu-rizing the hydroxy compd. by the usual methods in the presence of thiocyanic, ferrocyanic or ferricyanic compds. The products may be used as *bactericidal, fungicidal and pharmaceutical agents*. Several examples are given of producing Hg derivs. from *o*-cresol and its compds. Cf. C. A. 23, 1474.

Double compound of phenylallylbarbituric acid and 1-phenyl-2,3-dimethyl-4-dimethylamino-5-pyrazolone. F. HEFTI. Brit. 307,484, March 9, 1928. The components are melted together and form an *analgetic and sedative compd.*

Lanolin-like compositions. RUDOLF HAUSCHKA (to Gracia Ricardo). U. S. 1,728,205, Sept. 17. A natural ester such as castor oil (mixed with beeswax and petrolatum) is heated with a compd. formed by oxidation of an alc. with elimination of 2 atoms of H (suitably with CH_2O) and with a metallic catalyst such as Ni and the resulting layer of oil formed is sepd. and cooled to obtain a viscous mass, which is suitable for *pharmaceutical purposes*.

Dispensing tube for atomizing ethyl chloride. CHARLES L. GEBAUER. U. S. 1,727,876, Sept. 10. Structural features.

Surgical dressings, bandages, etc., formed of cellulose esters and ethers. C. DREYFUS (to British Celanese, Ltd.). Brit. 307,159, March 8, 1928. Cellulose acetate, formate, propionate or butyrate or methyl-, ethyl- or benzyl cellulose may be used.

Vitamins. T. SHIMIZU. Brit. 306,881, Feb. 26, 1928. Vitamin A is extd. from materials such as egg yolk, cod-liver oil, tomato, spinach and green algae, by removing cholesterol and the like from the unsaponifiable portion and pptg. the vitamin as a cholic acid from which the free vitamin may be obtained, described as white needles of the formula $\text{C}_{27}\text{H}_{46}\text{O}_2$. Numerous details of procedure are described.

Vitamin D. I. G. FARBENIND. A.-G. Fr. 659,448, Aug. 24, 1928. See Brit. 206,093 (C. A. 23, 2252).

Hormones. I. G. FARBENIND. A.-G. Brit. 306,606, Oct. 17, 1927. Hormones influencing the action of the heart are obtained from the hearts of warm-blooded animals by treatment with org. solvents. Various details and alternative procedures are described. Brit. 306,608 also relates to production of hormones from hearts by use of solvents. Cf. C. A. 23, 4778.

Hormones. SCHIERING-KAHLBAUM A.-G. Brit. 307,054, March 3, 1928. Hormones of sexual organs are obtained in water-sol. form by treatment with an aq. soln. of a weak acid such as lactic or tartaric acid instead of treatment with an alk. earth as described in Brit. 276,994 (C. A. 22, 2440).

18—ACIDS, ALKALIES, SALTS AND SUNDRIES

E. M. SYMMES

Hydrofluoric acid and its applications. MARCEL LEMIRE. *Bull. soc. ind. Rouen* 57, 16 21(1929). A brief description of the manuf. and applications of HF and of the analysis of fluorspar.

Sulfuric acid from smelter gases - a new contact process. ANON. *Eng. Mining J.* 128, 440-2(1929). An outline of the patented process of the Selden Co., in which a non-Pt contact mass is used. Conversion ranges from 97.5 to 98.5%. The contact masses, in which V is one of the catalysts, are extremely durable and resistant to reaction temps. and are astoundingly immune to gaseous poison. W. H. BOYNTON

Compressors of the "Sulzer" type as used in synthetic ammonia plants. R. W. MILLER. *Can. Chem. Met.* 13, 237-40(1929). The high pressure chem. gas industries have created a demand for compressors of intricate design, precision and great strength. A detailed description is given of Sulzer compressor units, with the main ideas prevailing in the synthetic NH_3 industry. The no. of stages is detd. by: economical working conditions; compression ratio control so that the temp. at each stage at the end of compression may not exceed a certain max.; and a cylinder arrangement to keep the stresses at a minimum.

W. H. BOYNTON
Large Demag compressors in works producing synthetic ammonia from coke-oven

gas. ANON. *Demag News* (Duisburg) 3, No. 3, 54-9(1929).—The process of manuf. of synthetic NH_3 is explained and details of design of 3-stage compressors are given.

E. I. S.

Phosphates and sulfuric acid. E. L. LARISON. *Eng. Mining J.* 128, 312(1929).— H_2SO_4 is produced at the Anaconda Reduction Works in two chamber units and a small packed cell unit. Gas obtained from the roasting of Cu concentrates, contg. 7-8% SO_2 , is used. The acid is used in the Zn plant and in prepg. a concd. acid phosphate and mono-ammonium phosphate.

C. L. READ

Sulfur, pyrite and sulfuric acid. ARTHUR E. WELLS. *Mineral Ind.* 37, 564-74 (1928).—Production, prices, trade and technology are discussed.

A. BUTTS

Action of ammonium carbonate and ammonia on calcium orthophosphates. L. HACKSPILL AND D. CLAUDE. *Chimie & industrie Special No.*, 453-7(Feb., 1929).—On treating pptd. $\text{Ca}_3(\text{PO}_4)_2$ in aq. suspension with $(\text{NH}_4)_2\text{CO}_3$ with continuous agitation 4% of the P_2O_5 was dissolved after 50 hrs.; this fell to 2.9% after 170 hrs. Similar results were obtained with basic slags. Natural phosphate rock gave entirely negative results. The results obtained with CaHPO_4 and $(\text{NH}_4)_2\text{CO}_3$ indicate that there is first formed $(\text{NH}_4)_2\text{HPO}_4$, which then reacts with the pptd. CaCO_3 with pptn of either a mixt. of CaHPO_4 and $\text{Ca}_3(\text{PO}_4)_2$ or a double salt, evidence pointing rather to the latter. The formation of $(\text{NH}_4)_2\text{HPO}_4$ is very slow, but much faster than its decompn. by CaCO_3 . Treatment of CaHPO_4 with NH_4OH gives $(\text{NH}_4)_2\text{HPO}_4$ and $\text{Ca}_3(\text{PO}_4)_2$, the reaction being considerably slower than the reaction with $(\text{NH}_4)_2\text{CO}_3$. $\text{CaH}_2(\text{PO}_4)_2$ and $(\text{NH}_4)_2\text{CO}_3$ react rapidly to give CaHPO_4 , $(\text{NH}_4)_2\text{HPO}_4$ and CO_2 , and the excess $(\text{NH}_4)_2\text{SO}_3$ reacts much more slowly on the CaHPO_4 as described above. NH_4OH reacts with $\text{CaH}_2(\text{PO}_4)_2$ according to the equations: $\text{CaH}_2(\text{PO}_4)_2 + 2\text{NH}_4\text{OH} = \text{CaHPO}_4 + (\text{NH}_4)_2\text{HPO}_4 + 2\text{H}_2\text{O}$ and $3\text{CaHPO}_4 + 2\text{NH}_4\text{OH} = \text{Ca}_3(\text{PO}_4)_2 + (\text{NH}_4)_2\text{HPO}_4 + 2\text{H}_2\text{O}$, the 2nd reaction being much slower than the 1st. On adding finely ground commercial superphosphate to $(\text{NH}_4)_2\text{CO}_3$ soln. there is abundant evolution of CO_2 and rapid increase in sol. P_2O_5 , this is followed by a rapid decrease in sol. P_2O_5 due to the reactions $\text{CaSO}_4 + (\text{NH}_4)_2\text{HPO}_4 = \text{CaHPO}_4 + (\text{NH}_4)_2\text{SO}_4$ and $3\text{CaSO}_4 + 2(\text{NH}_4)_2\text{HPO}_4 = \text{Ca}_3(\text{PO}_4)_2 + 3(\text{NH}_4)_2\text{SO}_4$; so that at the end of the reaction the soln. contained only 0.5% P_2O_5 and nearly all the SO_4 was present as $(\text{NH}_4)_2\text{SO}_4$. On dissolving the superphosphate in H_2O and filtering before adding $(\text{NH}_4)_2\text{CO}_3$ or NH_4OH the reactions were the same as those with pure $\text{CaH}_2(\text{PO}_4)_2$, as the soln. contains a little CaSO_4 (satd. soln.) the $(\text{NH}_4)_2\text{HPO}_4$ contains a little $(\text{NH}_4)_2\text{SO}_4$, but by concn. the clear superphosphate soln. to sirupy consistency and adding excess of NH_4OH , $(\text{NH}_4)_2\text{HPO}_4$ is pptd. as a cryst. mass contg. only traces of SO_4 . The CaSO_4 residue obtained on dissolving the superphosphate readily reacts with $(\text{NH}_4)_2\text{CO}_3$ to give $(\text{NH}_4)_2\text{SO}_4$ and a more or less impure residue of pptd. CaCO_3 . **Conclusions.**— $(\text{NH}_4)_2\text{HPO}_4$ cannot be prepd. from phosphate rock or from basic slags. Its prepn. from pptd. $\text{Ca}_3(\text{PO}_4)_2$ or CaHPO_4 is so slow as to offer no commercial interest, for the present at least, both $(\text{NH}_4)_2\text{HPO}_4$ and $(\text{NH}_4)_2\text{SO}_4$ can readily be prepd. from superphosphate.

A. PAPINEAU-COUTURE

Manufacture of phosphorus pentachloride. D. MANOEY AND V. MAZEL. *Trans. State Inst. Applied Chem.* (Moscow) 1927, No. 8, 39-45. —While prepg. PCl_5 by the lab. method, which consists in letting PCl_3 fall drop by drop in the presence of a current of Cl_2 , the vessel being cooled by water, it was found that the yield is very low on account of large quantities of unreacted PCl_3 . The yield can be increased greatly by stirring, and the method can be used on a large scale by operating in Fe app. Neither dry Cl_2 nor P chlorides attack Fe . Finely grained and perfectly dry PCl_3 was obtained at a 97% yield.

BERNARD NELSON

Sodium salts. ALAN G. WIKOFF. *Mineral Ind.* 37, 557-63(1928).—Nitrate, chloride, carbonate and sulfide are discussed with statistics.

A. BUTTS

Ammonium sulfate and sodium sulfate from technical sodium bisulfate and ammonia. HEINRICH MOLITOR. *Chem. Tech. Rundschau* 44, 795, 826(1929).—A discussion of the manuf. of $(\text{NH}_4)_2\text{SO}_4$ from crude bisulfate resulting from the production of HNO_3 by treatment of NaNO_2 with H_2SO_4 .

E. PICKERING

The Solvay process—a demonstration. ARTHUR HAUT. *J. Chem. Education* 6, 1763-4(1929).

E. J. C.

The character, properties and possible uses of bentonite, a sodium clay. R. M. WOODMAN AND E. MCKENZIE TAYLOR. *J. Soc. Chem. Ind.* 48, 121-5T(1929).—Bentonite consists mainly of a Na clay, showing the usual characteristics of liberation of NaOH by hydrolysis in H_2O and in impermeability to H_2O . It is a good emulsifier for certain oils, usually forming the oil-in-water type of emulsion suitable for the spraying of plants. In the case of cresylic acid it gives the dual types of emulsion. Bentonite is a water softener to some extent, acting by base exchange, useful in cases of permanent hardness.

The fault of bentonite for either use mentioned is its impermeability to water.

FRANK V. JOHNSON, JR.

Mineral raw materials. Survey of commerce and sources in major industrial countries. Bur. of Foreign and Domestic Commerce, *Trade Promotion Series 76*, 278 pp.(1929). E. J. C.

Borax. PAUL D. V. MANNING. *Mineral Ind.* **37**, 65-9(1928).—Uses, sources and production of borax are outlined. A. BUTTS

Cryolite. ANON. *Mineral Ind.* **37**, 227(1928).—Statistics of production and trade are given. A. BUTTS

Feldspar. ARTHUR S. WATTS. *Mineral Ind.* **37**, 228-30(1928).—Sources, production and technology are discussed. A. BUTTS

Fluorspar. HUBERT W. DAVIS. *Mineral Ind.* **37**, 231-5(1928).—A discussion of shipments, stocks and consumption. A. BUTTS

Graphite. BENJAMIN L. MILLER. *Mineral Ind.* **37**, 283-92(1928).—A discussion of the industry, with statistics of world production and trade. A. BUTTS

Gypsum. W. M. MYERS. *Mineral Ind.* **37**, 293-7(1928).—The industry is reviewed and statistics of production are given. A. BUTTS

The Canadian gypsum industry. R. M. SANTMYERS. Bur. Mines, *Circ. No. 6162*, 27 pp.(1929). ALDEN H. EMERY

Magnesite. PAUL M. TYLER. *Mineral Ind.* **37**, 389-99(1928).—Varieties and burning of magnesite are discussed, and statistics of production, prices and imports given. *Mg salts* and *Mg metal* are included. A. BUTTS

Mica. HUGH S. SPENCE. *Mineral Ind.* **37**, 411-25(1928).—Uses, varieties, production, imports and mica in foreign countries are discussed. A. BUTTS

Monazite. ANON. *Mineral Ind.* **37**, 430-1(1928). Statistics of monazite, *Th compds* and *Ce* are given. A. BUTTS

Talc and soapstone. PETER A. MCGURK. *Mineral Ind.* **37**, 575-82(1928).—Technology and research are discussed and statistics of output given. A. BUTTS

Aluminum and bauxite. C. L. MANTELL. *Mineral Ind.* **37**, 12-28(1928).—A statistical review of Al, Al salts and bauxite, including production, consumption, trade and new technical developments. A. BUTTS

Arsenic. PAUL M. TYLER. *Mineral Ind.* **37**, 34-40(1928). Production, trade, uses and consumption are discussed. A. BUTTS

Barium and strontium. CHARLES HARDY. *Mineral Ind.* **37**, 58-62(1928).—Discusses barytes, Ba products and Sr, with statistics. A. BUTTS

Bromine and iodine. ANON. *Mineral Ind.* **37**, 70(1928). Production and sources are given. A. BUTTS

Lead. REIGART M. SANTMYERS. *Mineral Ind.* **37**, 360-88(1928). World markets and production, trade, consumption and Pb pigments are reviewed and Pb metallurgy is discussed. A. BUTTS

The nitrogen problem in Poland on the basis of the map of sources of energy. WALENTY DOMINIK. *Przemysl Chem* **13**, 281-99(1929). Various methods of producing H₂ and NH₃ are discussed from the points of view of technology and economics. A plan for providing Poland with 100,000 tons of fixed N per yr. is worked out on the basis of distribution of peat deposits over the country. A. C. ZACHLYN

Potash. J. W. TURRENTINE. *Mineral Ind.* **37**, 502-11(1928).—The industry is reviewed, with statistics of world production and trade. A. BUTTS

Selenium and tellurium. S. SKOWRONSKI. *Mineral Ind.* **37**, 551-2(1928).—Production and uses are outlined and a bibliography is given. A. BUTTS

Titanium and zirconium. F. H. DRIGGS AND J. W. MARDEN. *Mineral Ind.* **37**, 599-606(1928).—Technology and production are discussed, with notes on *Hf*. A. B.

Asbestos. OLIVER BOWLES. *Mineral Ind.* **37**, 41-51(1928).—An account of technology and production. A. BUTTS

Fuller's earth. HERMAN GUNTER. *Mineral Ind.* **37**, 236-7(1928).—Statistics of production and trade are given. A. BUTTS

Phosphate rock. K. D. JACOB. *Mineral Ind.* **37**, 473-86(1928).—World production, uses and technology are discussed, with statistics and a bibliography. A. B.

Slate. CHAS. H. BEHRE, JR. *Mineral Ind.* **37**, 553-6(1928).—A review of production and uses, with discussion of technical developments and a bibliography. A. B.

Vanadium compounds as catalysts in the sulfuric acid industry. BRUNO WAESER. *Metalhbörse* **19**, 1349-50, 1406-7(1929).—A review, with citation of many patents involving the use of V compds. as catalysts for processes other than the oxidation of SO₂. W. C. EBAUGH

Platinized silica gels as catalysts for the oxidation of sulfur dioxide. HARRY

N. HOLMES, JAMES RAMSAY AND A. L. ELDER. *Ind. Eng. Chem.* **21**, 850-3(1929).—Under similar conditions Pt deposited on either (1) Holmes' chalky silica gel or on (2) Patrick's glassy silica gel is more efficient than on asbestos. At temps. slightly below those for max. conversion of SO_2 to SO_3 , Pt on (1) is more efficient than on (2), but little difference is observed at the temps. for max. conversion. The percentage conversion increases with increase in richness of the catalyst in Pt, and the optimum temps. decrease with increase in richness.

E. G. R. ARDAGH

* A review of the technically important hydrotropic compounds. R. WILHELM. *Chem. Umschau Fette, Oele, Wachse u. Harze* **36**, 198-203, 213-8(1929).—A discussion of the properties, consts. and prepn. of com. emulsifying, wetting or cleansing compds.

P. ESCHER

The testing of casein for industrial purposes. W. L. DAVIES. *Paper Makers Monthly J.* **67**, 279-83(1929).—See *C. A.* **23**, 4026.

A. PAPINEAU-COUTURE

Synthetic gems. GÖSTA ANGEL. *Teknisk Tid.* **59**, Kemi 80-83(1929).—A review of methods of synthesizing rubies, sapphires, padparadschahs and spinells and the way of distinguishing them from genuine gems is given.

GERHARD RUBEN

Precious and semi-precious stones. GEORGE F. KUNZ. *Mineral Ind.* **37**, 512-37(1928).—A statistical discussion of world sources and production, including diamonds, emeralds, rubies, sapphires, pearls, amethyst, jadeite, jet, opal, rhodonite and rock crystal.

A. BUTTS

Studies on the stability, bleaching action and products of decomposition of hypochlorite of soda solutions. V. I. MINAIEV, P. FORMIN AND G. YAKIMOV. *Rev. gén. mat. color.* **33**, 207-9, 337-9(1929).—Tabulated results are given showing properties of hypochlorite solns. prepd. from various concns. of Na_2CO_3 and Cl. A 13° Bé. lye contg. 93% of the theoretical % of Cl is the most stable.

H. F. LEUPOLD

Comparison of C_2H_2 black with gas black and lampblack (DAWSON, HARTSHORNE)

30. Apparatus for generating steam and vermicidal vapor for discharge through a nozzle (U. S. pat. 1,727,995) 1. Na_2CO_3 from waste liquors obtained in pulping wood (U. S. pat. 1,728,252) 23. Roasting ores [with production of gas for use in H_2SO_4 manufacture] (Brit. pat. 307,439) 9.

Hydrochloric acid. GEORGE P. ADAMSON (to General Chemical Co.). U. S. 1,729,431, Sept. 24. Substantially pure gaseous HCl is made by reaction of H_2SO_4 and salt at a temp. of about 113-118°. An app. is described.

Nitric acid. W. R. ORMSBY. Brit. 306,705, Feb. 21, 1928. A process is described identical with that described in Brit. 296,121 (*C. A.* **23**, 2253).

Phosphoric acid. I. G. FARBENIND. A.-G. Fr. 659,006, Aug. 14, 1928. Highly pure phosphoric acid is obtained by treating material contg. phosphoric acid with excess concd. H_2SO_4 , then after elimination of the CaSO_4 by pptn., the mixt. of H_2SO_4 and phosphoric acid is utilized for repeated attack of fresh quantities of the material until the H_2SO_4 is completely exhausted, and the phosphoric acid is isolated from the mud of acid and CaSO_4 .

Sulfuric acid cement. I. G. FARBENIND. A. G. Fr. 658,727, Aug. 8, 1928. In the production of H_2SO_4 and cement from gypsum or anhydrite with clay and coal, the premature combustion of the coal is prevented and excellent bricks are obtained by making the crude powdery mixt. into a paste with water and forming uniform pieces before roasting.

Sulfuric acid. HENRY F. MERRIAM (to General Chemical Co.). U. S. 1,728,213, Sept. 17. Atm. air is compressed and the compressed air is utilized for the oxidation of S-bearing material to produce a SO_2 gas which is then treated to form SO_3 . An arrangement of app. is described.

Utilizing solid carbon dioxide. HENRI DEHOTAY. U. S. 1,727,865, Sept. 10. Solid CO_2 in a heat conducting vessel such as a steel tank is gasified by heat passed through the walls of the vessel from the surrounding air.

Concentrating caustic alkalies. I. G. FARBENIND. A.-G. Brit. 306,935, Feb. 29, 1928. In order to produce fused KOH or NaOH a concd. soln. is evapd. in an inclined rotary tube, the entire inner surface of which is covered with the soln. or melt. The tube may be elec. heated and lined with Ag.

Ammonia synthesis. CARL MÜLLER and FRANZ KRÄGELOH (to I. G. Farbenind. A.-G.). U. S. 1,727,174, Sept. 3. Mixts. of H and N contg. small quantities of S compds., CO, O and water vapor as impurities are preliminarily brought into contact with a purifying mass comprising anhyd. K Al ferrocyanide which has a lower temp. than the catalyst used for NH_3 formation.

Ammonia synthesis, etc. GASVERARBEITUNGSGES. Brit. 307,027, March 1, 1928. In order to avoid weakening of app. by exposure to H at high temp., the H is heated in a heat-exchanger in counter-current with an inert gas such as N and the latter may be heated by passing it through a tube heated by direct flame or by molten metal. Preliminary heating of the cold gases to a temp. not exceeding 400° is effected by heat exchange with gases from the reaction or the gases may be heated by passing them through a purification catalyst contg. metals of the 8th group or their compds. and this heating effect may be increased by adding CO or O in small proportions. Water formed in the purification may be removed by freezing or otherwise.

Ammonia synthesis, etc. SOC. L'AIR LIQUIDE, SOC. ANON. POUR L'ÉTUDE ET L'EXPLOITATION DES PROCÉDÉS G. CLAUDE. Brit. 307,039, March 2, 1928. In NH₃ synthesis or other exothermic catalytic gas reactions, preliminary purification of the gases is effected in a container surrounded by the catalyst for the main reaction so that indirect heat exchange occurs and the temp. of the purifying reaction is thus controlled, e.g., in removing O and CO by catalytic hydrogenation from gases for NH₃ synthesis. An app. is described. Cf. C. A. 23, 4781.

Synthesis of ammonia. SOC. D'ÉTUDES MINIÈRES ET INDUSTRIELLES. Fr. 659,252, Dec. 14, 1927. See Brit. 302,306 (C. A. 23, 4304).

Catalysts for ammonia synthesis. A. O. JAEGER (to Selden Co.). Brit. 307,457, March 8, 1928. Catalysts comprise two- or multi-component zeolites or non-siliceous base-exchanging materials with which catalytically active components are assocd., either chemically combined in exchangeable or non-exchangeable forms or physically admixed during or after formation of the base-exchange material, or assocd. with diluent or in the form of anions forming salt-like compds. The catalyst is preferably pretreated with NH₃, H or N before use. Various details and modifications are described.

Aluminum compounds. W. BACHMANN. Brit. 307,345, March 5, 1928. AlF₃ or double alkali metal Al fluorides are formed by treatment of an Al salt such as the chloride, nitrate or sulfate with a metal fluoride such as an alkali metal or NH₄ fluoride in soln. or suspension (suitably with use of heating and pressure). Various details, examples and auxiliary procedures are described.

Cyanides. HERMANN WIEDERHOLD (to N.-V. Nederlandsche Mijnbouw en Handel Maatschappij). U. S. 1,727,261, Sept. 3. Material, such as moist coal humus, contg. humic substances is heated with water under pressure, the free humic acid is dissolved by adding a basic alk. compd. such as Na₂CO₃ and the soln. is sepd., coned by evapn., heated in the presence of an alk. compd. to produce coke, and the coke thus formed is heated to at least 1000° in the presence of N, in order to form cyanide. Cf. C. A. 22, 1218; 23, 673.

Cyanamides. STICKSTOFFWERKE G. M. B. H. (H. Heinrich Franck and Hugo Heilmann, inventors). Ger. 481,790, Oct. 29, 1926. Cyanamides of the alk. earth metals and Mg are prepd. by passing HCN or a mixt. of HCN and NH₃ over the oxide of the metal at temps. above 400°. The HCN may be mixed with indifferent gas. An example is given. Cf. C. A. 22, 3497.

Metallic chlorides. I. G. FARBENIND. A.-G. Brit. 307,524, Nov. 7, 1927. See Fr. 645,335 (C. A. 23, 1998).

Nitrates from nitrites. I. G. FARBENIND. A.-G. Brit. 306,998, Dec. 1, 1927. A nitrite such as KNO₂ is converted into the corresponding nitrate in the presence of water by the action of O or O-contg. gas under pressure (suitably 15 atm.) at a temp. above 150° (suitably 160-70°). A catalyst such as KOH may be used, and a starting material contg. both nitrite and nitrate (as obtained by the action of nitrous gases on oxide or carbonate) may be used.

Oxides of alkali-earth metals. WM. L. LAWSON. U. S. 1,729,428, Sept. 24. A mixt. of the carbonate of an alk. earth metal such as BaCO₃ is heated with a C catalyst such as petroleum coke in a closed vessel to a sufficiently high temp. (not exceeding about 1540°) to effect ready decompn. of the carbonate and evolution of CO₂ without substantial consumption of the catalyst; evolved gases are withdrawn and the reaction product is cooled under conditions not permitting any substantial oxidation of the C catalyst.

Orthophosphates. I. G. FARBENIND. A.-G. Fr. 659,300, Aug. 23, 1928. Alkali orthophosphates are prepd. by heating below 250° alkali chlorides and phosphoric acid while blowing steam or gases contg. it through the reaction mass. A sulfate, bisulfate or H₂SO₄ may also be added.

Treating iron-bearing sulfides. S. I. LEVY and G. W. GRAY. Brit. 306,691, Feb. 10, 1928. S and Fe₂O₃ are produced from sulfidic material contg. Fe such as pyrites, pyrrhotite, chalcopyrite or mats by chlorination (in which the heat of reaction maintains the desired temp.), and subsequent oxidation of the FeCl₂ formed. FeCl₃ or Cl from the

oxidation or S chlorides formed by combining the Cl with the S obtained may be used in the chlorination, with or without inert gases, and the temp. may be controlled by varying the chlorinating agent or its rate of supply. Numerous details are given.

Aluminum oxide from the sulfide. METALLGESELLSCHAFT A.-G. (Freiherr C. von Girsowald, inventor). Ger. 481,660, Mar. 5, 1926. See U. S. 1,713, 411 (C. A. 23, 3313).

• **Ammonium and calcium nitrate.** APPAREILS ET ÉVAPORATEURS KESTNER. Fr. 658,522, Aug. 2, 1928. A stable mixt. of NH_4NO_3 and $\text{Ca}(\text{NO}_3)_2$ is obtained by using in the mixt. a $\text{Ca}(\text{NO}_3)_2$ previously concd. to less than 18% of water.

Ammonium chloride. CHEMISCHE FABRIK GROSS-WEISSANDT G. M. B. H. and PAUL SEIDLER. Ger. 481,696, Nov. 26, 1926. Addn. to 467,184 (C. A. 23, 487). The crystals of NH_4Cl prepd. from vegetable sources, as described in 467,184, are obtained in larger size by using pectin substance or its disintegration products as the starting material.

Ammonium sulfate from gases. UNION CHIMIQUE BELGE SOC. ANON. Brit. 307,037, March 2, 1928. In treating gases from fuel carbonization or distn. to sep. acid impurities by washing with ammoniacal liquor as described in Brit. 262,320 (C. A. 21, 3716), the washing liquor is satd. with $(\text{NH}_4)_2\text{SO}_4$ so that addn. of NH_3 or $(\text{NH}_4)_2\text{CO}_3$ in the scrubbing tower causes sepn. of $(\text{NH}_4)_2\text{SO}_4$. An arrangement of app. and various details of procedure are described. Cf. C. A. 23, 3780.

Calcium arsenate. WILLIAM C. PIVER (to Franklin M. Simpson). U. S. 1,727,306, Sept. 3. Ca oxide is hydrated with an aq. soln. of another compd. such as $\text{Ca}(\text{NO}_3)_2$ having a low sp. gr. and adapted to produce a coarse-grain and quickly setting $\text{Ca}(\text{OH})_2$ of reduced soly. and the latter is treated with an arsenic acid soln. Cf. C. A. 22, 2035.

Carbon disulfide. EBERHARD LEGELER and PAUL ESSELMANN (to I. G. Farbenind. A.-G.). U. S. 1,728,686, Sept. 17. In order to purify crude CS_2 contg. H_2S and other S compds., the crude liquid is introduced into the upper part of a rectification column, the soln. collecting at the bottom of the column is heated, refluxing of materials at the top of the column is effected; purified CS_2 is withdrawn from a point near the bottom of the column and a concd. soln. of S and S compds. is withdrawn from the bottom.

Chromic oxide. HERMANN C. ROTH. U. S. 1,728,510, Sept. 17. A mixt. of an alkali dichromate and a reducing agent contg. S is ignited, without addn. of other oxidizing agents, in proportions to transform the excess S present into substantially pure S in vaporized state by exothermic reaction. The vapors are condensed and the residue is leached to dissolve out alkali metal sulfate. App. is described.

Cobalt carbonyl. I. G. FARBENIND. A.-G. Brit. 307,112, Dec. 3, 1927. In effecting reaction between Co and CO, oxidizing agents such as O_2 , CO_2 or water vapor are excluded both from the reducing gas used in prepg. the metal and from the CO. Treatments for prepg. reduced Co and purified CO are described. Cf. C. A. 23, 3058.

Magnesium perchlorate and barium perchlorate composition. GEORGE F. SMITH. Fr. 659,031, Aug. 14, 1928. A granular compd. contg. $\text{Mg}(\text{ClO}_4)_2$, which is anhyd. and has no affinity for CO_2 , is obtained by associating the $\text{Mg}(\text{ClO}_4)_2$ with $\text{Ba}(\text{ClO}_4)_2$, either by evap. a soln. of the 2 salts to dryness, or by spraying anhyd. $\text{Ba}(\text{ClO}_4)_2$ with a soln. of $\text{Mg}(\text{ClO}_4)_2$ and drying or by mixing crystals of $\text{Ba}(\text{ClO}_4)_2 \cdot 3\text{H}_2\text{O}$ with $\text{Mg}(\text{ClO}_4)_2 \cdot 6\text{H}_2\text{O}$ and drying. The $\text{Mg}(\text{ClO}_4)_2$ may be prepd. by grinding together an appropriate anhyd. compn. contg. Mg and NH_4ClO_4 .

Purifying magnesium sulfate solutions. SHELDON B. HEATH (to Dow Chemical Co.). U. S. 1,727,597, Sept. 10. MgSO_4 soln. contg. chlorides such as those of Na and Mg is subjected to multiple-effect evapn., cooled to produce MgSO_4 crystals in high chloride mother liquor, the crystals are sepd. from the mother liquor, redissolved and the soln. is concd. in an effect at lower temp. to form crystals of MgSO_4 in a mother liquor of lower chloride content, the crystals are sepd. and the mother liquors are recycled, raw liquor is added to the lower temp. effect through an intermediate effect in which it is partially concd., excess mother liquor from the lower temp. effect is led to the high temp. effect, and high chloride residual mother liquor is eliminated from the system. An arrangement of app. is described. Cf. C. A. 23, 2791.

Lead oxides. CHESTER H. BRASELTON. U. S. 1,728,388, Sept. 17. Melted Pb is sprayed into a stream of highly heated gases contg. O and ozone. App. is described.

Potassium chromate. VEREIN FÜR CHEMISCHE UND METALLURGISCHE PRODUKTION. Ger. 481,852, Apr. 1, 1923. K_2CrO_4 is prepd. by heating chrome iron ore with mixts. of K_2CO_3 and MgCO_3 or double salts such as $\text{KHCO}_3 \cdot \text{MgCO}_3 \cdot 4\text{H}_2\text{O}$.

Sodium phosphate. WILLIAM H. LOHMANN (to General Chemical Co.). U. S. 1,727,551, Sept. 10. In furnacing a mixt. of alkali sulfate such as Na_2SO_4 , H_3PO_4 and carbonaceous material, the proportions of sulfate and H_3PO_4 in the charge are regulated to provide substantially 92-95% by wt. of the alkali sulfate theoretically required to

combine with the H_3PO_4 to produce tri-alkali phosphate. This proportioning serves to facilitate the process and minimize sulfide production.

Sodium tetraborate. ALFRED W. GAUGER and HENRY H. STORCH (to Burnham Chemical Co.). U. S. 1,727,639, Sept. 10. Seales Lake brine or other brine contg. Na, K, borate, carbonate, chloride and sulfate ions is brought to satn. with K Na sulfate and the temp. is subsequently raised to crystallize out Na carbonate sulfate only, and the brine is then treated to crystallize out borax.

Titanium hydroxide. JOSEPH BLUMENFELD (to Commercial Pigments Corp.). U. S. reissues 17,429-30, Sept. 10. See original pat. 1,504,672 (C. A. 18, 3257).

Fluorine. JAN H. DE BOER (to N.-V. Philips' Gloeilampenfabrieken). U. S. 1,728,230, Sept. 17. Zr oxyfluoride or other suitable F O compd. of Ti, Zr or Hf is heated in the presence of O. An app. is described. When using Zr oxyfluoride a temp. of somewhat above 200° is suitable for producing F.

Apparatus for the production of chlorine. WM. E. KEMMERICH. U. S. 1,729,043, Sept. 24. An app. is described in which the gradual production of Cl will cause a gradual gravitational contact of the reacting substances such as $KMnO_4$ and HCl. The app. is suitable for generating Cl for therapeutic inhalation.

Hydrogen. RUDOLF L. BATTIG. U. S. 1,726,877, Sept. 3. See Canl 284,117 (C. A. 23, 677).

Hydrogen. I. G. FARBENIND. A.-G. Brit. 307,529, Dec. 2, 1927. A gas consisting substantially of H or a H N mixt. for NH_3 synthesis is obtained by exposing solid, liquid or gaseous materials such as coke oven gas or natural gas together with air, O or CO_2 , with or without steam, to the action of an elec. arc and converting the CO formed into H and CO_2 by treatment with steam, then sepg. the CO_2 . The process is so regulated that combustion of the H content of the materials used takes place only to a slight extent. Cf. C. A. 23, 677.

Hydrogen. ÉTAT JAPONAIS (KOKUKENKYUJO). Fr. 658,515, Aug. 2, 1928. The danger of explosion with H is reduced by adding thereto vapor of petroleum hydrocarbons, C_6H_6 , toluene, alc., ether or vapor of org. compds. of metals.

Phosphorus. SOCIETÀ ELETTRICA DELL' ARSA (Giuseppe Nigra, applicant in Italy). Fr. 658,521, Aug. 2, 1928. A mixt. of phosphorites, sand and charcoal in considerable excess is heated, by electrodes plunged into the mass, to a temp. at which the phosphorites and sand melt, the fused material being completely surrounded by a mass of incandescent charcoal, the vapors of P filtering through the charcoal as well as CO which prevents oxidation of the P.

Phosphorus; cement. I. G. FARBENIND. A.-G. Fr. 659,743, Aug. 14, 1928. P or phosphoric acid and a hydraulic cement in the latent state are produced by melting crude phosphates of Ca and Al in such proportions that the slag produced is a hydraulic cement having a compn. similar to blast furnace slag (Al_2O_3 12-35, SiO_2 18-38, CaO 40-55%) and can be transformed like it into a blast furnace cement. Cf. C. A. 23, 2539.

Phosphorus and its compounds. WM. H. WAGGAMAN and HENRY W. EASTERWOOD (to Victor Chemical Works). U. S. 1,728,948, Sept. 24. A briquetted mixt. of natural phosphate, silica and a solid reducing agent such as coke is heated in a continuous rotary kiln at a temp. not exceeding 1500° and the materials are so proportioned that they do not form a readily fusible residue at such temp.

Potassium. I. G. FARBENIND. A.-G. Fr. 658,508, Aug. 2, 1928. K is obtained by strongly heating KF with metallic Mg.

Sulfur. PATENTAKTIEBOLAGET GRÖNDAL-RAMÉN. Fr. 659,095, Aug. 17, 1928. Ores such as pyrites are fused in a blast furnace having the mouth closed, with reducing material such as coke, so that not only the SO_2 formed during the fusion is reduced to S, but the O is transformed into CO or CO_2 . The S is condensed from the escaping gases. Other details of operating are described.

Extracting sulfur from sulfur ore, etc. ARTHUR J. CROWLEY (to Humboldt Sulphur Co.). U. S. 1,729,246, Sept. 24. Superheated water is passed through the material to melt out the S, and the molten S and residue are forced through a restricted passage to solidify and divide the S.

Furnace for roasting sulfur ores, etc. METALLGESELLSCHAFT A.-G. Fr. 659,977, Sept. 5, 1928.

Apparatus for fusing phosphate materials. SOC. DES PHOSPHATES TUNISIENS. Fr. 658,770, June 11, 1928.

A gas shaft kiln. WILHELM MÜLLER. Ger. 482,111, Feb. 20, 1926. A gas shaft kiln for burning lime, dolomite, magnesite and similar ores has a central internal column and an outlet below the shaft for the burned product.

Oxidation catalysts. NATIONAL PROCESSES, LTD. Fr. 659,044, Aug. 29, 1928.

Catalysts for the oxidation of gases, such as SO_2 , by air are produced by causing a hydrogel of Cr hydrate to absorb one or more insol. or slightly sol. bases by placing the hydrogel in contact with a soln. of salts of the said base or bases and afterward allowing to dry.

Regeneration of metallic catalyzers. GEWERKSCHAFT KOHLENBENZIN. Ger. 481,927, May 24, 1924. Metallic catalyzers poisoned with S are regenerated by reducing their temp. to 100° and passing over them a current of org. acid vapor. H_2S is evolved and the org. salts formed are decomposed by heating.

Activated charcoal. JOHN J. NAUGLE. Fr. 658,638, Aug. 6, 1928. A plant is described for activating or revivifying charcoal in which the charcoal is heated in thin layers to about 450° and partially oxidized by air.

Vegetable char. CHARLES E. COATES (to Oscar L. Barnebey). U. S. 1,729,162, Sept. 24. Vegetable material such as sugar-cane trash is charred by destructive distn. and the resulting char is heated in the presence of air to above 550° to burn out most of the H and a limited amount of C, cooled while excluding air, treated with inorg. acid soln. and dried.

Composition for absorbing noxious odors. JOHN M. BRANDLEY. U. S. 1,728,656, Sept. 17. Blocks suitable for use in refrigerators, etc., are formed of powdered hardwood C 90, gum acacia 3.5 and sugar 10 lb., admixed with water 4 gal.

Condensation products. PIERRE CHESTAKOFF. Fr. 659,695, Dec. 22, 1927. Hard infusible condensation products for making plates, etc., are made by heating to 80–100 a mixt. of cresol and CH_3O in the presence of feebly active catalysts such as oxalic acid, succinic acid, $\text{Zn}(\text{AcO})_2$, $\text{Pb}(\text{AcO})_2$, decanting the water and heating on a water bath for complete dehydration. It is afterward mixed with org. monosulfonic acids of high mol. wt. and dispersive power, poured into molds and heated to $110\text{--}130^\circ$ to harden.

Condensation products of acetylene and ammonia. I. G. FARBENIND. A.-G. Fr. 658,614, Aug. 6, 1928. Condensation products of C_2H_2 and NH_3 are obtained at a high temp. by using as catalysts finely divided oxides of Th and Zr, a dried gel of activated SiO_2 , contr. nitrates or oxides of Zn and Th, etc. The products are useful for *denaturing alc.*

Aldehyde condensation products. MICHAEL MELAMID. U. S. 1,727,076, Sept. 3. An aldehyde such as CH_3O is dild. with an electrolyte in excess such as H_2SO_4 and the mixt. thus prepd. is used for treating hydroxyaromatic hydrocarbons such as PhOH to form products of fusible character.

Phenolic condensation products. OSCAR A. CHERRY and FRANZ KURATH (to Economy Fuse and Mfg. Co.). U. S. 1,726,650, Sept. 3. Products which are suitable for various purposes are formed by heating a reaction mixt. formed of CH_3O or other reactive CH_2 -contg. substance, PhOH, furfural and a substance such as $(\text{CH}_3)_3\text{N}_4$ which will liberate NH_3 , in which the reactive CH_2 -contg. material is in sufficient proportion that an infusible product may be obtained on heating. Cf. C. A. 23, 3060.

Phenolic condensation products. FRANZ KURATH (to Economy Fuse and Mfg. Co.). U. S. 1,726,644, Sept. 3. Furfuramide is used for treating fusible products such as those formed from CH_3O and a phenol to fix the reactive CH_2 group-contg. substance in non-volatile and reactive form.

Molded knobs of phenolic condensation products. WM. A. SCHMITTGEN (to General Industries Co.). U. S. 1,728,218, Sept. 17. Mech. features of molding are described.

Moldable compositions containing powdered metals. F. KRITTP A.-G. (to F. Hauptmeyer). Brit. 307,011, March 1, 1928. Alloys such as Cr-Ni, Cr-Ni-Fe and Cr-Fe are used with various binders such as dental or other cements, varnishes, S, tar, asphalt, rubber, waterglass or resins for making vessels or pipes for use in the chemical or brewing industries or as dental fillings.

Molded fiber articles. MEYER M. FROST. U. S. 1,726,818, Sept. 3. An aq. fibrous pulp is mixed with an adhesive such as rosin soap and water is expressed. The material is molded under high pressure, dried and then impregnated with molten S by vacuum and pressure treatment. Articles such as chair seats or boxes may be made in this manner.

Plastic materials. I. G. FARBENIND A.-G. Fr. 659,116, Aug. 17, 1928. See Brit. 295,940 (C. A. 23, 2293).

Plastic composition. E. H. S. BROWNE and A. M. SARGINT. Brit. 307,625, March 5, 1928. An easily worked mass is formed from powdered glass 10 lb., ZnSO_4 13.6 oz. and sufficient 58° Tw. K silicate soln. to produce the desired consistency. After setting, the mass may be further hardened by treating it with a soln. of CaCl_2 .

Plastic compositions. SPICERS, LTD. Fr. 659,141, Aug. 18, 1928. Plastic compns.

of cellulose esters and ethers, particularly cellulose acetate, for the production of films, silk, etc., contain a mixt. of diphenylcresylphosphate and phenyldicresylphosphate in such relative proportions that a mixt. is obtained corresponding, as regards its content of phenyl, cresyl and phosphoric anhydride groups, to a mixt. of phenylphosphate and cresylphosphate contg. 45-65% of the former to 55-35% of the latter.

Plastic composition suitable for holding seeds on pottery vases. PAUL W. LEFFLAND. U. S. 1,726,906, Sept. 3. Seeds such as grass seed are mixed with wood pulp and water, and the mixt. may be applied to vases or the like to permit germination of the seeds.

Adhesive. I. G. FARBERIND. A.-G. Fr. 658,666, Aug. 7, 1928. Finely divided solid substances such as ground asbestos are added to adhesives having a basis of cellulose esters.

Adhesives, fabric finishing or emulsifying compositions, etc. ORANIENBURGER CHEMISCHE FABRIK A.-G. Brit. 307,079, March 2, 1928. Materials such as starch, dextrin, vegetable gums, gelatin, gluc or casein are dissolved in org. solvents insol. in water by use of a solubilizing agent comprising a soap or soap-like substance in aq. soln. together with a water-sol. org. solvent such as alc., a phenol, a hydrogenated phenol, a ketone, chlorohydrin, an ester or dioxane. Various examples are given. Aliphatic or aromatic hydrocarbons may be used as the water-insol. solvents.

Drying casein. PASQUIER MEESE ET CIE. Brit. 306,824, Feb. 25, 1928. Casein or similar material is dried by conveying it over porous surfaces (which may be endless conveyers) through which hot air is forced by a fan. An app. is described.

Composite sheets of paper, metal foil, etc. H. HANSEN. Brit. 306,910, Feb. 27, 1928. Material suitable for packing purposes comprises sheets of paper united with each other or with metal foil by an adhesive comprising asphalt, tars, tar distillates or the like, which may be applied in a solvent such as light or heavy tar oils, CHCl_3 , C_6H_6 or "petrol."

Sound record composition. LEO RUTSTEIN. U. S. 1,727,040, Sept. 3. Cellulose acetate is used with a plasticizer such as alkyltoluenesulfonamide and triphenyl phosphate together with shellac, fillers, coloring matter and cotton flock.

Sound record composition. LEO RUTSTEIN (to Celanese Corp. of America). U. S. 1,727,039, Sept. 3. Rotton stone 100, finely ground "record mass" 100, china clay 75, mica 40, lampblack 5, cotton flock 10, orange shellac 10 parts are admixed with 80 parts of plastifier composed of cellulose acetate and a non-volatile solvent.

Printing surfaces and sound records. DEUTSCHE GASGLÜHLICHT-AUER-GES. Brit. 307,505, March 9, 1928. Surfaces for reproduction of drawings or for making sound records are made of a compn. contg. resin, artificial resin, rubber, etc., and an in-org. filling material of extremely fine grain such as TiO_2 , the particles of which may be about $1\ \mu$ or less in size.

Printing plates. LAWRENCE C. TURNOCK. U. S. 1,727,259, Sept. 3. Mech. features of backing up of Cu shells with tin foil and other material.

Acoustic diaphragm. CLARENCE S. WICKES (to Victor Talking Machine Co.). U. S. 1,729,305, Sept. 24. Sound-reproducing diaphragms are formed from a rolled sheet of Al of at least 99.8% purity and of high internal resistance.

Acoustic diaphragms of impregnated fabric. LESLIE STEVENS (to Stevens Mfg. Co.). U. S. 1,729,407, Sept. 24. Diaphragms such as those for radio loud speakers are formed of seamless stretched fabric rendered resilient, held in shape and waterproofed by treatment with a compn. such as a nitrocellulose lacquer formed with AmOAc and contg. a small proportion of a gum or wax to prevent brittleness when dried and with which Al or bronze powder also may be mixed. Numerous details are described.

Brake lining of impregnated fabric treated with glycerol. FREDERICK C. STANLEY (to Raybestos Co.). U. S. 1,729,138, Sept. 24. The glycerol serves to prevent freezing of the lining to the brake drum in cold weather. Cf. C. A. 23, 4543.

Friction material for brake and clutch linings, etc. J. S. THOMPSON. Brit. 307,442, Dec. 5, 1927. Asbestos is used with a binder such as lined oil and a pyrobituminous material or material which yields bituminous substances when subjected to heat such as peat, lignite, bituminous coal and coking coal. The mixt. is molded under pressure and dried.

Composition for use on brake and clutch linings. E. F. GINGRAS (to Liquid Veneer Corp.). Brit. 307,342, March 5, 1928. A compn. for treating worn surfaces of brake or clutch linings and the like comprises a soln. of a resinous gum in a volatile solvent with which may also be admixed solid materials such as loose asbestos fiber, cotton, leather, Mn oxide, ground slate, mica or limestone. Oil, graphite or soapstone may be added to prevent "squeaking," and abrasive powders also may be added.

Dynamo brush composition. NELSON R. HAAS (to Delco-Remy Corp.). U. S. 1,729,343, Sept. 24. Brushes are formed of graphite, waterglass and a non-abrasive moldable binder such as bakelite. Cf. C. A. 23, 2002.

Grinding and polishing diamonds. CLAES W. BOMAN (to Joyce-Koebel Diamond Tool Department, Inc.). U. S. 1,727,425, Sept. 10. A surface of Arkansas stone is used.

Solvents and cleansing agents. E. I. DU PONT DE NEMOURS & Co. Fr. 658,520, Aug. 2, 1928. New products capable of use as solvents, cleansing agents and *antiseptic soaps* are made by the reaction of aliphatic or sulfonated fatty acids with alkylamines, particularly those contg. a hydroxylated aliphatic group. Several examples are given.

Apparatus for polishing wood floors, etc. SOC. DE PARIS ET DU RHÔNE. Brit. 306,938, Feb. 29, 1928. A polishing disk or cylinder of flexible material such as rubber has incorporated in it abrasive particles such as carborundum, glass or small iron shavings.

Wetting and softening agents. ORANIENBURGER CHEMISCHE FABRIK A.-G. Fr. 659,538, Aug. 25, 1928. Wetting and softening agents resistant to lyes and salt solns. are composed of aliphatic or aromatic or aliphatic-aromatic sulfonic acids of high mol. wt. or their salts and org. hydroxy-, keto- or hydroxy-keto-acids or their salts or acid amides or simple unsubstituted carboxylic acids along with alcs. or ketones of low mol. wt., or carboxylic esters. Aliphatic or hydroaromatic alcs. or ketones may be added to any of the mixts.

Detergents. BRITISH DYESTUFFS CORP., LTD., J. BADDILEY and E. CHAPMAN. Brit. 307,141, Dec. 23, 1927. Detergents suitable for use on tiles, walls, stoneware, glass, metals and painted or polished surfaces consist of aq. solns. or pastes of the complex sulfonic acids or their salts described in Brit. 284,367 (C. A. 22, 4741) and of niter-cake or other inorg. acid cleansing agent.

Washing liquid. EUGENE SCALES. U. S. 1,728,082, Sept. 10. "Com." Na_2CO_3 2 lb. and finely pulverized limestone 8 oz. are mixed with water 9 qt. and the mixt. is boiled for a half hr.; after cooling there is added a soln. of CaCl_2 3 oz. and water 3 qt., a cold soln. of Na_2CO_3 and a further quantity of CaCO_3 are added, and excess CaCO_3 is subsequently removed from the soln.

Carbon papers. FIRM OF G. WAGNER. Brit. 307,435, March 7, 1928. A compn. for making carbon papers comprises a soln., in a volatile solvent, of natural or artificial rubber, gutta-percha, balata or their isomers, natural or artificial resins, esters or the like or mixts. of these, together with coloring matter such as a suitable pigment lake. Softening agents, vulcanizing agents, accelerators, etc., may also be added.

Vegetable glue base. ELLERY H. HARVEY (to Perkins Glue Co.). U. S. 1,726,824, Sept. 3. Starch substantially free from gluten and in substantially dry powdered form is mixed with a powdered peroxide such as BaO_2 .

Belting of woven fibrous material. ERNST W. KOHLSCHÜTTER. U. S. 1,728,567, Sept. 17. Belting is impregnated with a hot benzene soln. of "gutta-percha-like" asphaltic bitumens, the benzene is evapd. and the impregnated belting is then treated with acetone or alc. or other suitable solvent for the greasy paraffinic constituents only of the bitumens.

Puncture-sealing composition. J. A. STRANGE. Brit. 306,641, Dec. 9, 1927. Cork or leather dust is mixed with mica, gelatin, CH_2O , pig's hair and a gum.

Carboy loading, moving and tilting apparatus. LADISLAUS W. SCHWENK. U. S. 1,727,523, Sept. 10.

Stencil sheet coating composition. SHINJIRO HORII. U. S. 1,729,072, Sept. 24. Quince oil is used as a softening agent with esters of polysaccharides such as cellulose nitrate and other ingredients.

Coating and filling composition from disintegrated leather. PETER C. CHRISTENSEN. U. S. 1,728,391, Sept. 17. After removal of oils, fats and similar substances from leather, it is boiled in water until disintegrated and a gunmy mass settles out; the latter is dissolved in an alkali soln. such as NaOH and this soln. is treated with not more than about 2% of a 40% CH_2O soln. The product thus prepd. is suitable for use as a coating, sizing, stiffening or filling compn.

Transparent material for use as a "glass substitute." W. H. MOSS (to British Celanese, Ltd.). Brit. 307,462, March 8, 1928. Openwork or reticulated material such as wire netting is enclosed in a coating of a synthetic resin and cellulose acetate or other org. deriv. of cellulose which may be successively applied to the support. Numerous details and examples are given.

Sheets of gelatin-sulfonated oil composition. EDOUARD M. KRATZ (to Marsene Products Co.). U. S. 1,727,611, Sept. 10. Sheets are prepd. by spreading the compn.

over a surface comprising linseed oil and other blended oils such as oil-treated muslin and, after cooling, and drying, stripping the sheet formed from the surface.

Insect repellent. WARREN MOORE and HYM E. BUC (to Standard Oil Development Co.). U. S. 1,727,305, Sept. 3. Di-Et or di-Bu phthalate or other dialkyl phthalate is used with a solvent such as kerosene in prep. a compn. which may be sprayed on horses or cattle.

Adhesives for catching insects. I. G. FARBENIND. A.-G. Brit. 306,906, Feb. 27, 1928. Various compns. are formed of ingredients such as chlorinated train oil, carnauba wax, chlorinated tall oil, castor oil, machine oil, bleached montan wax acids and esterified ozocerite.

Exterminating animals in underground burrows. JAMES W. VAN METER. U. S. 1,727,457, Sept. 10. Reactive material (such as sawdust, metal particles and creosote) which reacts with Cl to form a poisonous gas and smoke is placed in the burrow and Cl is then supplied to the latter.

Device for blending streams of foam-producing fire-extinguishing solutions. FENNEL C. J. MOORE (to Bethlehem Shipbuilding Corp.). U. S. 1,727,111, Sept. 3. A stream-blending and spray-forming device is described.

19--GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

West-country glasshouses. FRANCIS BUCKLEY. *J. Soc. Glass Tech.* **13**, 124-9T (1929). H. F. KRIEGER

Simple test for the detection of iron oxide in glass sands. J. T. RANDALL AND R. E. LEEDS. *J. Soc. Glass Tech.* **13**, 15-6 (1929). When a sample contg. more than 0.01% Fe_2O_3 is heated in a stream of dry H_2 at 1000° for 30 min. the darkness produced is sufficiently distinct to serve as a rapid control test on bulk deliveries of sand.

H. F. KRIEGER

Influence of grain size of the batch materials on the rate of melting. MRS. G. A. GREEN, F. W. HODKIN, MICHAEL PARKIN AND W. E. S. TURNER. *Glass Research Assoc. Bull.* No. 10 (April, 1924). *J. Soc. Glass Tech.* **13**, 57-63T (1929). The melting rate increased with greater fineness of soda ash, limestone and sand. The danger of introducing more impurities with the finer sizes of sand limits the fineness to which this may go.

H. F. KRIEGER

Influence of cullet on the rate of melting and other properties of soda-lime-silica glass. F. W. HODKIN, H. W. HOWES AND W. E. S. TURNER. *J. Soc. Glass Tech.* **13**, 25-37 (1929).—The cullet used was prep. either by cooling the glass dry or by quenching it in H_2O . This made no difference on the batch behavior. It is not essential that cullet be seed-free. In general increasing the amts. of cullet above 10% increased the melting rate of the batches, decreased the elimination of seed and increased the viscosity.

H. F. KRIEGER

Effect of cullet on the melting and working properties of potash-lead oxide-silica glasses. S. ENGLISH, MRS. G. A. GREEN, F. W. HODKIN AND W. E. S. TURNER. *J. Soc. Glass Tech.* **13**, 37-47 (1929). Increasing the cullet beyond 50% retards the rate of melting but to a lesser extent than with soda-lime glasses. A slight increase in the working viscosity also results whether the meltings are made in open or covered pots.

H. F. KRIEGER

Influence of the addition of small quantities of alkaline salts on the ease of melting and on the working properties of soda-lime-silica glasses prepared from cullet. F. W. HODKIN, W. E. S. TURNER AND F. WINKS. *Glass Research Assoc. Bull.* No. 12 (Feb., 1925); *J. Soc. Glass Tech.* **13**, 47-56T (1929). The most effective salt used in producing easy melting and refining, combined with good working properties and least extensive corrosion, was Na_2CO_3 , followed by $\text{Na}_2\text{B}_4\text{O}_7$. Glasses contg. large amts. of cullet became fine earlier, were slower in setting and had a longer working range when small addns. of alkali salts were made.

H. F. KRIEGER

Experiments on the re-melting of glasses of abnormal working properties. MRS. G. A. GREEN, F. W. HODKIN AND W. E. S. TURNER. *Glass Research Assoc. Bull.* No. 13 (June, 1925); *J. Soc. Glass Tech.* **13**, 64-70T (1929). The remelted glasses were all slightly more viscous and quicker setting than the original glasses. However, when small quantities of Na_2SO_4 were used in the remelting, the glass was always easy working.

and of lower viscosity and setting rate than either the original or the re-melted glass.

H. F. KRIEGE

Theory of glass drawing and blowing. HEINZ SCHLECHTWEG. *Ann. Physik* [5], 2, 805-46(1929).—A mathematical paper.

E. J. C.

Relations between physical characteristics of glasses and their working properties on machines. G. GEHLHOFF. *J. Soc. Glass Tech.* 12, 145-57P(1929).—The limitations of working glass by machine are set by the working range viscosities, effect of heat losses from the glass and thermal vol. changes, devitrification tendencies, resistance to mech. and thermal shock and annealing rate. The tendency to adhere to the molds depends on the compns. of both mold and glass.

H. F. KRIEGE

Relationship between the physical properties of glasses and their suitability for manipulation by machine. F. W. ADAMS. *J. Soc. Glass Tech.* 12, 114-9P(1929).—Since the mech. manipulation of glass is comparatively inelastic the chem. and phys. properties of glasses must be within narrow limits to be successfully worked. The compn. limits of the usual glasses worked in this way are given. Suggestions are made as to the conditions necessary to produce homogeneous glass.

H. F. KRIEGE

The viscosity of glass. S. ENGLISH. *J. Soc. Glass Tech.* 12, 106-13P(1929).—Present methods of viscosity measurements and their results are discussed. The viscosities at which glasses may be worked range from $10^{2.5}$ for small hand-made articles to $10^{3.5}$ (C. G. S. units) for heavy machine-made ware. At the annealing pt. the viscosity is 10^{13} .

H. F. KRIEGE

Measurement of the viscosity of glass at high temperatures by the rotating cylinder viscometer. R. F. PROCTOR AND R. W. DOUGLAS. *Proc. Phys. Soc. (London)* 41, 500-19(1929). The molten glass is contained in a sillimanite pot provided with a coaxial cylindrical stirrer which is caused to rotate by means of a falling weight. The viscometer was calibrated by the use of sirup and pitch, the falling ball method being used. Contrary to the earlier conclusion of Washburn, a single calibration factor was found over a wide viscosity range. Various errors are discussed, particularly an error caused by skins developing on the surface of the glass. It is considered that the errors from all sources are less than 6% at 1200°. Results are given in abs. units from 600° to 1200°, and are shown to be in agreement with earlier data as corrected.

EUGENE C. BINGHAM

Note on the viscosity of some glasses of abnormal working properties. S. ENGLISH AND W. E. S. TURNER. *Glass Research Assoc. Bull.* No. 10 (Apr., 1924); *J. Soc. Glass Tech.* 13, 70-6T(1929).

H. F. KRIEGE

Velocity of crystallization in soda-lime-silica glasses. E. ZSCHIMMER. *J. Soc. Glass Tech.* 13, 76-84T(1929).—Devitrification depends on the no. of crystal nuclei present and the velocity of crystn. Cristobalite and sometimes tridymite, CaSiO_3 , and $\text{Na}_2\text{O} \cdot 3\text{CaO} \cdot 6\text{SiO}_2$ can be pptd. as soon as the equil. point is overstepped. The rate of crystal growth was studied by measuring the length of crystals produced in 0.05 g. samples of glass held at definite temps. Devitrification occurred first at the glass-gas interfaces such as at the exterior or about gas bubbles entrapped within the mass. Charts are given showing the velocities of crystn. The position of the velocity curves varies regularly with the chem. compn. The max. velocity should be of the least possible value and should occur at the lowest possible temp. Glasses having 12-18% Na_2O should have 26% Na_2O plus CaO .

H. F. KRIEGE

Gases in glass. II. The gas and moisture content of glasses. A. BECKER AND H. SALMANG. *J. Soc. Glass Tech.* 13, 98-111T(1929); cf. *C. A.* 22, 1661.—Small bubbles which appear during the refining of molten glass may be caused by the escape of air from pores in the contg. vessel, reduction of sulfate in the glass, the formation of H_2S in S-contg. glass and by action of glass on Fe if such is present. Water is added with considerable difficulty to glass by introducing it in the batch or by poling. Quantities up to 0.075% were added by passing H_2O vapor through the melt. The H_2O acts chemically upon the glass at high temps. since it apparently is more acid than the glass.

H. F. KRIEGE

Analysis of the gases emitted by glass. S. KONDRASHEVA. *J. Applied Phys. Moskau* 5, 23-38(1928); *Physik. Ber.* 9, 2012. (In Russian with English Summary).—A method is described for the detn. of the gases given off by glass below its m. p. under 10^{-4} mm. pressure. Three kinds of glasses have been tested. Below the softening point, gases are given off which are vigorously absorbed by alk. oxides. Above the softening point, H and CO are liberated: they were probably dissolved in the glass.

ALBERT L. HENNE

Note on the reduction of glasses in hydrogen. J. T. RANDALL AND R. E. LEEDS. *J. Soc. Glass Tech.* 13, 16-9T(1929).—The oxides of As and Pb are reduced by dry H_2 at

600–700° sufficiently to discolor glasses contg. them. Fe_2O_3 in glass is reduced less.

H. F. KRIEGER

Note on a method of testing the probable durability of tank blocks. E. J. C. BOWMAKER. *J. Soc. Glass Tech.* 13, 130–40T(1929).—The solubilities of chips of the blocks are detd. in HF and H_2SO_4 under definite conditions. The greater the soln. taking place in these acids the less resistant is the block to corrosion and erosion in service. A block of the right compn. and heat history is resistant to both molten glass and HF. Porosity is no safe index to corrosive resistance.

H. F. KRIEGER

Distribution of temperature and block corrosion in glass tank furnaces. F. F. S. BRYSON. *Glass Research Assoc. Bull.* No. 13, (June, 1925); *J. Soc. Glass Tech.* 13, 140–61T(1929).—By means of Pt-PtRh thermocouples inserted through the tank blocks so as to be protected from the atm. of the tank, a satisfactory measure and control of the temps. of the glass are obtained. Air-cooling the outer surfaces of blocks appreciably lowered their temps. without chilling the glass within even when the block was only 4" thick. Considerable daily temp. variations were found. The corrosion was greatest near the surface of the glass, 1" of the block being removed in 3 weeks. At 10" and 16" depths the time for removing 1" was 2½ and 7 months, resp.

H. F. KRIEGER

A further note on the fracture of systems of glass. F. W. PRESTON. *J. Soc. Glass Tech.* 13, 3–15T(1929).

H. F. KRIEGER

Theory and design of plate-glass polishing machine. II. F. W. PRESTON. *J. Soc. Glass Tech.* 13, 111–23T(1929); cf. *C. A.* 22, 671.

H. F. KRIEGER

Brief outline of the history, development and methods employed in the manufacture of laminated glass. WESTCOTE R. LYTTLETON. *J. Soc. Glass Tech.* 13, 85–91T(1929); cf. *C. A.* 23, 3784.

H. F. KRIEGER

Heat-resisting steels with special reference to their application in the glass industry. R. J. SARJANT. *J. Soc. Glass Tech.* 13, 167–82T(1929).

H. F. KRIEGER

Application of colloid chemistry to the study of clays. II. A. ERIC J. VICKERS. *Trans. Ceram. Soc.* 28, 124–47(1929); cf. *C. A.* 23, 4034.—Because of clay's state of division some of its chem. and phys. traits can best be studied as colloidal phenomena. The effect of electrolytes on the pH and viscosities of clay suspensions is discussed. Colloidal chemistry aids in the proper handling of clays of unusual properties, likewise impurities, changes in the plasticity, etc. A bibliographic review is included.

H. F. KRIEGER

Factors governing the durability of clay building materials. I. W. ANGUS MCINTYRE. *Trans. Ceram. Soc.* 28, 101–23(1929).—Of the several factors entering into the weathering process those biological and purely chem. are of slight importance in the disintegration of clay bricks, roofing tiles and terra cotta. The concn. of solns. and crystn. of salts are the most destructive forces. These salts are derived mainly from the ceramic materials themselves and to lesser extent from the mortar, soil, atm., etc. Frequent washing reduces and may even prevent the destructive action of these accumulated salts. Porosity of the material is no mark of its weathering properties. Texture and structure, such as laminations, underburning, etc., have a more definite bearing.

H. F. KRIEGER

Investigations into the durability of architectural terra-cotta and faience. W. A. MCINTYRE. Dept. Sci. Ind. Research (Brit.), *Building Research Special Rept.* No. 12, 68 pp (1929).—The report includes a short historical outline of architectural terra-cotta, a discussion of its manuf., factors governing its durability, exptl. work and a description of observed failures of English terra-cotta. These failures have been due either to weathering or to the disrupting action of block fillings made of coke breeze or clinker concrete. In weathering the biological forces are negligible in this connection; the chem. forces are important chiefly in their contribution to the salt concns. in localized areas of the terra-cotta while the phys. forces are most disruptive. Of these the expansion stresses due to differences in material (as in filling and glaze), in moisture content and in temp. are all effective to some extent, though of lesser importance considered singly. Abrasion by wind and dust depends on the geographical location of the structure. Rupture by freezing is an important disintegrating force especially if the materials pores are largely satd. The satn. coeff. of Kreiger which is the ratio of absorption to porosity is accepted as a fair criterion for the measure of resistance to freezing action, the safe value being about 0.8. To measure the resistance of glaze to frost action, M. suggests 2" × 2" × 0.5" specimens. The surfaces are flooded with 10% eosin soln. for 5 min., washed and the cracks present measured. After boiling for 5 hrs. and cooling under H_2O the specimens are frozen at –15° for 24 hrs., thawed in H_2O , dried and flooded with eosin. This is repeated until cracking develops. Since the crystn. of salts, chiefly sulfates of Ca, Na and K, is the most destructive agency in the weathering of terra-cotta the Na_2SO_4

soundness test is of value *per se* as well as a substitute for freezing and thawing. For the test 14% solns. of K_2SO_4 and Na_2SO_4 were used, specimens were dried for 7 hrs. at 105° and soaked for 17 hrs. After 50 such cycles no disintegration was caused by the K_2SO_4 soln. while most of the specimens in the Na_2SO_4 showed some disruption. The results of the test accord fairly well with the observed behavior of the specimens under actual weathering. Porosity itself apparently has no effect on the resistance to weathering, the size and distribution of the pores being of greater moment. Osmotic pressure has little effect in the weathering of terra-cotta. Conclusion: The salts found disrupting the weathered material come from the terra-cotta primarily and to a small extent from the soil, mortar, air, backing, etc. The high Na:K ratio found in the efflorescence indicates a selective soly. process not unlike that of natural silicates contg. alkali. Chem. compn. of the ware and soln. studies with CO_2 , SO_2 and H_2SO_4 did not bear any definite relation to the weathering behavior. Terra-cotta is in the main a first-class building material in its ability to withstand weathering and where defects occur they are mainly due to underburning.

H. F. KRIEGE

Comparison of the properties and industrial durability of lime-bonded and clay-bonded silica bricks. W. J. REES AND W. HUGILL. *Trans. Ceram. Soc.* 28, 221-50 (1929).—The bonds used included 4 ball clays, 2 china clays, a plastic fireclay and a marl purified by electroösmosis. Bricks were made and tested for their mech. strength and refractoriness. Clay-bonded silica bricks can be made by the same process of manuf. as lime-bonded bricks. Better spreading of the clay bond was obtained by deflocculating the slip with Na silicate. With $3\frac{1}{2}\%$ ball clay the mech. properties and refractoriness were approx. equal to normal bricks with 2% lime bond; likewise the working properties, except that the clay bond is more sensitive to H_2O content variations. Under com. conditions of burning little difference was noted in the rates of inversion. Bricks without either clay or lime bond had the greatest degree of inversion. The spalling of the clay-bonded bricks was lower than the lime-bonded bricks though the resistance to corrosion was less. In coke ovens the durabilities are about equal. Thus it is stated that clay-bonded bricks are not superior to silica bricks bonded with lime.

H. F. KRIEGE

Modern facing bricks. ALFRED B. SEARLE. *Trans. Ceram. Soc.* 28, 339-49 (1929).—The need of pleasing shapes and colors as well as good mech. strength and phys. properties is stressed.

H. F. KRIEGE

Drying cracks in firebricks. CHRISTOPHER E. MOORE. *Trans. Ceram. Soc.* 28, 193-200 (1929).—The chief causes of cracks are the faulty drying operation and the improper mixing, shaping and handling of the ware to induce strains. A "danger zone" is that part of the drying process when the movement of H_2O through the mass is rapidly decreasing and the contraction with H_2O loss is decreasing while the strength is increasing but slowly. The gradation, amt. and kind of grog affect the cracking tendencies.

H. F. KRIEGE

Comparative effects on an earthenware slip of varying soda-silica ratios in silicate of soda. K. SILK AND N. D. WOOD. *Trans. Ceram. Soc.* 28, 252-60 (1929). See C. A. 23, 4313.

H. F. KRIEGE

The testing of porcelain insulators. B. F. GOODLET. *Engineering* 127, 774 (1929).—The majority of porcelain insulators now on the market were tested to one of the national insulator specifications which had as their basis the following fundamental requirements: the mech. strength of the insulator must be sufficient for the required purpose; the puncture voltage must exceed the spark-over voltage under all conditions of climate and load; the insulator must be completely non-porous, and must withstand sudden fluctuations of temp. over a limited range. The following basic tests correspond to these requirements: elec., dry and wet spark-over voltage, puncture voltage; mech. strength, temp. cycle and porosity. The various tests are briefly reviewed. There are many phenomena about which the tests called for in the various standard specifications gave little information. Some alterations in these specification therefore appear to be desirable.

W. H. BOYNTON

Kilns and kiln firing. II. Dunnachie continuous gas-fired kiln. S. R. HIND. *Trans. Ceram. Soc.* 28, 148-64 (1929); cf. C. A. 23, 4034.—The kiln and gas producer are described and their heat-balances given. The burning of the ware is substantially to cone 15 and under conditions conducive to the production of highest quality refractories. **III. The Belgian ring kiln.** *Ibid* 204-19.—The fuel consumption and efficiency factor are good for a firebrick kiln of this type. It is difficult to maintain uniform firing and kiln atms. **IV. Woodall-Duckham chamber kiln.** *Ibid* 261-75.—The heat balance indicated too great a loss by conduction. The fuel consumption was 15.5% on the weight of fired goods. Some difficulties were observed in maintaining kiln atms. because of the inleaking about the fire mouth. The bulk of the setting is fired to cone 10-12

and is reasonably good as regards heat distribution. V. The E. I. C. T. tunnel kiln. *Ibid* 316-32.—The subject of the report is the tunnel kiln constructed by "Etudes industrielles et constructions thermique" at Paris. This kiln gave good results with grogged fireclay and semi-silica firebricks, etc. The firing of the kiln was fairly satisfactory though tending to be periodic. Goods were burned to a desired degree safely and in a short time. The cooling curve was very good. VI. A study of fuel consumption up to various times during the firing of a down-draught kiln used for large fireclay lumps. *Ibid* 352-62.—The progressive relation between time, temp. and fuel consumption was studied with firing fireclay lumps to cone 13. The kiln was fired by 87% (fired weight of goods) of an inferior rough slack. The loss by unburned matter in the ash was 10.9%. The formula $W' = a \theta t^b (1 - b\theta)$ was developed, in which W' , θ and t are, resp., the fuel consumed, kiln temp. and time of firing while a and b are constants. The cooling curve can be closely accounted for on accepted theoretical grounds, allowance being made for the variation with temp. of the phys. consts. of firebrick. H. F. K.

Mechanical stokers. G. E. SCHOLES. *Trans. Ceram. Soc.* **28**, 310-6 (1929). H. F. KRIEGER

Abrasives. V. L. HARDLEY-WILMOT. *Mineral Ind.* **37**, 1-11 (1928). A review of production and technology. W. H. BUTTS

Some industrial tests on refractory materials. W. H. SIMMONS. *Ind. Chemist* **5**, 338-41 (1929).—App., devised by Endell and Steger, for the detn. of refractoriness under load, expansion up to 800°, expansion up to 1600° and spalling of refractory materials is described. K. D. JACOB

The functions of regenerators in relation to the refractory materials of construction. A. T. GREEN. *Trans. Ceram. Soc.* **28**, 165-91 (1929). Refractoriness, heat capacity, mech. strength, resistance to abrasion and fluxing are all desirable in a regenerator refractory. Silica, siliceous or fireclay brick combine these properties most economically. H. F. KRIEGER

The development of specifications of refractories in countries outside of Germany. W. STEGER. *Tonind.-Ztg.* **53**, 1199, 1217, 1261 (1929). A history of American testing methods. R. E. FERGUSON

Refractory formers for electric heating elements; some problems in the manufacture and use. P. COOPER. *Trans. Ceram. Soc.* **28**, 333-7 (1929). The qualifications of first-class refractory formers for elec. heating are good thermal strength, reasonable mech. strength, sufficient dielec. strength at working temps., negligible variation in size, economically feasible in manuf. and pleasing in color. The presence of alkali, especially Na, in the refractory promotes the formation of a green coating due to the Ni deposited from the heating element by the electrolytic action. This occurs chiefly with d. c. If excessive, it may cause the element to burn out. H. F. KRIEGER

Dissociation of carbon monoxide in contact with refractory materials. D. W. HUBBARD AND W. J. REFS. *Trans. Ceram. Soc.* **28**, 2-30, 1929. Refractory materials were heated in a silica tube through which purified CO was sent at 1 atm. The progress of the reaction $2CO \rightarrow CO_2 + C$ was followed by the detn. of gas pressure and also by the estn. of the CO formed. The following temperatures promoted the dissocn. of CO at the temps. given: pure kaol. 450°, 450-495°; pure kila 30-570°; pure alumina 260°, 370°; firebrick 110°, 430°, 700°; kaolin treated with pure silica 430°, 480°, 520-545°; silica brick 530-540°; returned firebrick 380°, 470°. Scotch firebrick 340-450°, 470-500°; calcined clay 400-400°; calcined dolomite 70-770°; pure FeO 300-700°. A burned firebrick has the catalytic behavior of both Al_2O_3 and SiO_2 . Fe oxide in refractories increases the dissocn. of CO. H. F. K.

The significance of technical physics for the glass industry (ZSCHIMMER) 13. The transformation products of quartz (WINTER, HUFER) 2. Heat conduction problems (GRIFFITHS) 2. Synthetic gums (ANGEL) 18. Treating Cu slag (U. S. pat. 1,728,005) 9.

EYER, PH.: Entwurf und Berechnung eines Emaillierwerks. Halberstadt VERLAG P. EYER. 34 pp. M. 3.50. Reviewed in *Chimie et industrie* **22**, 225 (1929).

Glass. N.-V. PHILIPS' GLOEILAMPENFABRIEKEN. Brit. 307,563, Dec. 23, 1927. A batch such as that suitable for manuf. of glass of a low coeff. of expansion is united to form a coherent body (suitably by pressing into small rods and sintering these together) and the material is then melted.

Glass-melting furnace. JULIEN M. AUCCOURIER. Fr. 659,352, Aug. 23, 1928. Apparatus for feeding mold charges of molten glass. KARL E. PRILER (to Hartford-Empire Co.). U. S. 1,727,379, Sept. 10. Structural features.

Mold mechanism for glass-working machines. RUSSELL M. SEARLE (to Corning Glass Works). U. S. 1,727,221, Sept. 3. Structural features.

Mold for forming glassware. CARL W. SCHWENZFEIER (to Owens-Illinois Glass Co.). U. S. 1,729,363, Sept. 24. Structural features.

Apparatus for producing sheet glass. JAMES C. BLAIR (to Libbey-Owens Glass Co.). U. S. 1,729,147, Sept. 24. Structural features.

Sheet glass annealing leer. ENOCH T. FERNGREN (to Libbey-Owens Glass Co.). U. S. 1,729,164, Sept. 24. Structural features.

Apparatus for conveying glass sheets through leers at regulated speed. EUGENE GENTIL and PIERRE L. A. MATHE (to American Bicherox Co.). U. S. 1,728,538, Sept. 17. Devices for driving rollers at different speeds are described.

Forming and annealing sheet or plate glass. C. HEUZE. Brit. 307,302, March 3, 1928. An app. and various mech. features of operation are described.

Composite glass sheets. J. H. SHERTS (to Du Pont Viscoloid Co.). Brit. 306,891, Feb. 27, 1928. An unpolished sheet material such as celluloid and gelatin is fed directly from the sheet between 2 sheets of glass and they are united under pressure of 150–500 lb. per sq. in. at a temp. of 100–115° for 1½–10 min.

Decolorizing glass. WILLIAM C. TAYLOR (to Corning Glass Works). U. S. 1,726,635, Sept. 3. CeO_2 and MnO_2 are used together to counteract the coloring effect of Fe present.

Laminated glass. JAMES W. H. RANDALL (to Libbey-Owens Sheet Glass Co.). U. S. 1,727,937, Sept. 10. Two glass sheets are joined by an intervening sheet of woven fibrous material impregnated with a substantially colorless resin such as a synthetic resin. Cf. C. A. 23, 1486.

Laminated glass. JOSEPH A. REECE (to Libbey-Owens Glass Co.). U. S. 1,729,125, Sept. 24. Mech. features.

Splinterless glass. GEORGE E. HEYL and MORRIS GREENHILL. Fr. 659,946, Sept. 4, 1928. Means are described for pressing the sheets together under liquid pressure.

Reënforced glass. SOC. DES USINES CHIM. RHÔNE-POULENC. Fr. 658,563, Aug. 3, 1928. Reënforced glass is made by plunging 2 sheets of glass and a sheet of plastic material having a basis of cellulose acetate or other cellulose deriv., superficially softened and free from volatile solvents, into a bath composed of plastifying agents for the plastic material, and pressing the plastic sheet between the sheets of glass. Fr. 658,564 describes a process whereby adherence of the plastic sheet to the glass is obtained by interposing a film composed of polymerized vinyl acetate and plastifiers for cellulose acetate.

Signs made of "selenium stippolite" glass or like material. W. W. LEITH. Brit. 307,630, March 14, 1928.

Refractory material suitable for lining glass-melting tanks. JESSE T. LITTLETON, JR. (to Corning Glass Works). U. S. 1,728,350, Sept. 17. Material such as a refractory silicate is heated until molten, poured into a mold and granular particles of approx. the same constituents are added to the molten material and cooled with it so that a cryst. mass is formed in which the crystals are heterogeneously arranged.

Repairing refractory walls of glass tanks, etc. DONALD W. ROSS and JAMES M. LAMBIE. U. S. 1,727,675, Sept. 10. A mixt. of granular aluminous material such as corundum or cyanite together with a flux such as feldspar or Pb oxide and a bonding clay is applied to the glass-engaging surfaces of the walls before firing and the structure is heated to the point at which mullite crystals are formed.

Purifying clay and similar materials. FERNAND PARENTANI. U. S. 1,727,441, Sept. 10. The material is subjected to a vacuum, treated with gaseous H_2S at atm. temp. and in the absence of water, sulfides formed are dissolved, and the material is sepd. from the soln. An app. is described.

Molding bricks. F. BANDINI. Brit. 307,550, Dec. 12, 1928. Wet clay contg. not less than 20% of moisture is heated to about 95° and passed through an extrusion app. maintained at about the same temp.; the extruded material is cut into bricks and the bricks are passed directly to a drying oven and dried at a gradually increased temp. up to 120–130° in an atm. of suitably regulated humidity.

Fire brick. ENOCH P. STEVENS. U. S. 1,727,138, Sept. 3. Raw refractory brick clay which breaks down by weathering to a relatively granular condition (as distinguished from a mud-producing powder) is artificially weathered to the granular state by application of moisture and heat and the granules are calcined and may be molded with a binder. An app. is described.

Salt glazing of ceramic wares in colors. HOBART M. KRANER (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,766, Sept. 17. A mixt. of NaCl and another metallic

chloride (such as chlorides of Co, Cr or Fe), the oxide of which will combine with silica to produce a colored silicate, is volatilized in the presence of the ceramic ware.

Cold-glazed tiles, etc. USINES DE AL BASSE-MEUSE, SOC. ANON. and O. RUPPEL. Brit. 306,615, Nov. 28, 1927. A compn. for producing a glazed effect on cement, concrete or the like is formed of a mixt. of portland and slag cements, an org. acid and coloring matter. Hardening may be accelerated by use of a moist atm. contg. CO_2 or by use of a bath contg. Na_2CO_3 and a sol. silicate.

Coloring tiles while in plastic condition. EDWIN H. WHITE. U. S. 1,727,580, Sept. 10. An app. is described in which vibration is used to assist penetration of layers of plastic cements of different colors.

Ceramic compositions. JULIUS SCHNEIDEMANDEL and HANS SCHNEIDEMANDEL. Ger. 481,611, May 6, 1925. A ceramic heat insulator is made by mixing water glass and lime or MgCl_2 and MgO with excess of water and drying off the water from the finished product. BaO or ZnO may also be used. An agglutinant such as albumin and a filling material such as kieselguhr or furnace dust may be added.

Ceramic products. I. G. FARBENIND. A.-G. Fr. 658,886, Aug. 10, 1928, Fe_2O_3 in a finely divided state is added to ceramic products before baking to produce a red color. Cf. C. A. 23, 4546.

Opauqing agents. DEUTSCHE GASGLÜHLICHT-AUER-G. M. B. H. Fr. 659,518, Aug. 24, 1928. Opauqing agents are made by melting together Zr silicate and about the equiv. amt. of CaO , SrO , BaO , MgO or ZnO with the addn. of a flux to produce finely divided combinations of Zr silicate and the oxides.

Porcelain articles. ARTHUR S. WATTS. U. S. 1,728,382, Sept. 17. In forming artificial teeth or other articles, a porcelain mixt. is subjected to a gradually increasing temp. until the desired vitrification is effected, and the temp. is then abruptly raised to fuse the surface of the article and form a glazed coating on the surface; the temp. is then abruptly lowered to arrest fusion, and the product is annealed and cooled.

High-voltage electric insulator. WALTHER ESTORFF (to Westinghouse Elec. & Mfg. Co.). U. S. 1,728,531, Sept. 17. A dielectric such as porcelain or glass is coated with a material, e. g., linseed varnish or lime, capable of interaction with the electrostatic field to prevent the formation of a conductive medium on the surface.

Refractory materials for furnace linings, etc. VEREIN FÜR CHEMISCHE UND METALLURGISCHE PRODUKTION. Brit. 307,580, Jan. 16, 1928. Fused refractory material such as Al_2O_3 , Zr oxide or silicate, Th or Ce oxides, is used with refractory plastic clay or bauxite and readily fusible salt sol. in water such as sulfates, phosphates, chlorides, fluorides or borates.

Refractory articles. JEAN D'ANS (to Deutsche Gasglühlicht G. m. b. H.). U. S. 1,728,748, Sept. 17. In making bricks or other refractory articles, pure ZrO_2 is mixed with up to 5% of oxides of alk. earth metals, the mixt. is sintered and the articles are formed from the sintered mixt. Cf. C. A. 23, 3505.

Enamels. LEICHTMETALL-VERWERTUNGS-GES. Brit. 307,259, June 15, 1928. Lepidolite and similar natural or synthetic materials are used for enameling metal articles such as those of iron and may be fired at 1000° .

20—CEMENT AND OTHER BUILDING MATERIALS

J. C. WITT

A criticism of the standard cement tests with regard to deciding strength. BERTEL GRITLIN. *Rock Products* 32, No. 13, 43-6(1929); cf. C. A. 23, 685.—G. advocates the use of test mixts. of higher water-cement ratio than now used in standard tests.

RAYMOND WILSON
Calculation of the best cement raw batch. HANS KÜHL. *Zement* 18, 833-7(1929). H. F. KRIEGE

Notes on the manufacture of cements and hydraulic limes. R. BLIN. *Tech. Moderne* 21, 297-301, 335-8, 403-6(1929).—Modern methods concerning these products are described. P. THOMASSET

Causes of the unsoundness of an aluminous fused cement. A. F. ROSCHER LUND. *Zement* 18, 718-23, 748-53(1929). H. F. KRIEGE

Estimation of the quality of portland cement by chemical methods. ARTHUR J. POOL. *Rock Products* 32, No. 13, 59-60(1929).—A relationship is developed between 7-day tensile strength and the quantity of lime extd. from the cement by water under definite conditions. RAYMOND WILSON

The cause of unsoundness of portland cement. WM. LERCH. *Concrete* (Mill Section) 35, No. 1, 109-12, No. 2, 115-8(1929).—With the standard steam test as a criterion of soundness, the pure compds. of portland cement singly and in mixts., and lab. and com. cements of low free-CaO content were found to be sound. Cements contg. more than about 2% free CaO were unsound. Apparently free CaO is the only cause of unsoundness in the steam test. RAYMOND WILSON

The unsoundness factor in portland cement manufacture. ALTON J. BLANK. *Rock Products* 32, No. 14, 72-4(1929).—No unsoundness has been observed in cement contg. less than about 2% free lime. Cement of good quality can be made from unsound clinker by aging if the unsoundness is the result of overliming and the clinker is well burned. RAYMOND WILSON

Question of reducing the water cement content of the slurry in the manufacture of portland cement by the wet process. P. P. BUDNIKOV, G. V. KUKOLEV AND V. M. LESHCHYEV. *Zement* 18, 746-7(1929).—Viscosity values are given for slurries contg. 40-48% H₂O with and without addns. of alkali. The slurry which was 0.01 N with Na₂-SiO₃ was as fluid with 42.5% H₂O as the original slurry with 48% H₂O. Na₂CO₃ and NaOH were less effective in maintaining the fluidity with less H₂O. H. F. KRIEGE

Calcium sulfate retarders for portland cement clinker. ERNEST E. BERGER. *Bur. Mines, Tech. Paper* 451, 35 pp.(1929).—See C. A. 23, 496. ALDEN H. EMERY

Determination of free lime in slags and cements. E. DIEPSCHLAG AND A. MATTING. *Zement* 17, 1306-8, 1337-40, 1373-6(1928); cf. C. A. 22, 4752.—In a discussion of previous methods it is pointed out that certain essentials have been overlooked. The soln. used must not form compds. of higher heats of formation than CaAl₂O₄ or CaFe₂O₄, nor dissolve these salts, and must dissolve CaO. Such a solvent is glycerol. It forms Ca glyceride under non-aq. conditions. To 1 g. of the finely powd. material in a 250-cc. Erlenmeyer flask add 5-10 cc. c. p. glycerol free from H₂O, stopper tightly and shake at intervals for 24 hrs. Add 25-50 cc. abs. alc. and a few drops of phenolphthalein, heat to simmering on a water bath, keeping the flask covered as much as possible. Titrate the CaO dissolved with alc. NH₄AcO or better with 0.1 N tartaric acid. Good results are claimed for this method. H. F. KRIEGE

Tests of powdered admixtures in concrete. DUFF A. ABRAMS. *Proc. Am. Soc. Testing Materials* 29, Pt. II (reprint) 36 pp.(1929).—Several admixts. with cement were studied as to their effect on strength and workability. These admixts. included hydrated lime, limestone, colloidal clay, calcined moler clay, volcanic ash, slag, precipitator dust and diatomaceous earth. From 2 to 15% was used based on the wt. of the cement. Colloidal clays gave the greatest reductions in strength and diatomaceous earth next. This reduction was greater at 1, 2 and 3 days than at 7 days to 3 months. None of the admixts. improved the workability. There was an intimate relation between the normal consistency of the non-hydraulic admixts. and the reduction in concrete strength. A similar relation was found for the water factor of these admixts. H. C. PARISH

Effect on concrete of acid water from stored bituminous coal. EDGAR F. WOLF. *Ind. Eng. Chem.* 21, 908-10(1929).—When concrete is first exposed to this acid water corrosion is relatively rapid but the insol. or slightly sol. Ca and Fe salts which are produced form a protective film which retards further corrosion. Limestone would become practically ineffective in neutralizing this acid water after a short period under conditions in which the protective film is not continually removed. H. C. PARISH

Action of water sweated out of concrete on metals. F. HUNDESHAGEN. *Zement* 18, 6-11; *Pit & Quarry* 18, No. 12, 41-4(1929).—NaOH, KOH and some Ca(OH)₂ were found in the H₂O condensed on concrete structures. The alkali was sufficient to attack Al. When the Al was imperfectly covered with waterproof paint, blistering occurred due to the pressure of the evolved H₂. The blistering of paint on concrete under water is due primarily to air forced out of the concrete by the capillarity of H₂O getting in. H. F. KRIEGE

Investigations on the setting process and the hardening of concrete in freezing chambers. RICHARD GRÜN. *Zement* 17, 1371-3, 1400-5, 1471-3(1928).—The strength of concrete allowed to cure at room temp. 1-3 days before it is subjected to freezing temps. is fair although below that of concrete which remains at room temps. Cement and concrete intended for low-temp. service should be tested after several days of curing at higher temps. While the addn. of CaCl₂ aids in attaining an early strength, special high early strength cements are available so that CaCl₂ is unnecessary. Freezing tests on mortar or small concrete specimens are not applicable to mass concrete at low temps. Concrete exposed to freezing temps. continually should be rich in cement, contg. about 7 sacks per cu. yard, and should have well-graded aggregates. H. F. K.

Chemistry of bituminous highway construction: native asphalts. JOHN S. MILLER, JR. *Chemistry and Industry* 48, 782-6(1929).—The geography of the Trinidad and Bermudez lakes is discussed, also the appearance and characteristics of the asphalt from each. The methods of mining and refining are described. Richardson's theory of asphalt formation is quoted. Comments are made on the usual methods employed for testing asphalts to be used for paving. Two maps and 5 illustrations are included.

E. G. R. ARDAGH

Pitch and its suitability for road building. WALTER OBST. *Teer u. Bitumen* 27, 425-7(1929).—A review, with some patent references.

W. H. STAEBNER

Condition of building materials after fires. D. DÜWER. *Zement* 18, 810-4(1929).

H. F. KRIEGE

The deterioration of structures of timber, metal and concrete exposed to the action of sea water. JOHN PURSER AND H. J. GROSE. *Dept. Sci. Ind. Research, 9th Rept. Comm. Inst. Civil Eng.* 1929, 69 pp.—Reports on the final examination of iron and steel specimens exposed at Plymouth and Colombo for five years. J. NEWTON FRIEND. Similar tests at Auckland and Halifax were concluded in 1928 (cf. C. A. 22, 3754). The 4 sets show satisfactory agreement. The widest variation in results was in the aerial tests, the least in the complete immersion in sea-water tests. Low Moor wrought Fe was superior to Swedish iron in all exposures. In air mild steels were superior to wrought Fe. S and P are deleterious in mild steel. At half-tide and complete immersion wrought Fe is superior to mild steel. In fresh-water complete immersion wrought Fe and mild steel behaved alike. The addn. of 0.6 to 2.0% Cu increased the resistance of mild steel 10 to 30%, whereas 3.75% Ni added 50% increased resistance. High-Cr steel was highly resistant but showed severe pitting on continuous immersion. Cast Fe appeared to be highly resistant in all tests except fresh-water but showed evidence of internal corrosion. Cold-blast was superior to hot-blast metal. When dissimilar metals were exposed in contact, one was preserved at the expense of the other. At half-tide Cr and high-Ni steels were remarkably preserved by contact with mild steel. Strength tests indicated that loss in weight and loss in strength are roughly proportional when bars are not deeply pitted. Cast and wrought Fe, mild and Cu steel lost about equally in strength; high-Ni steel showed lowest loss and high-Cr steel as a result of severe pitting had the highest loss. Reports on painted and tarred steel plates exposed to aerial corrosion at Southampton and Weston. Super-mare. J. NEWTON FRIEND. Report on protection of timber 1927-1928. GEO. BARGER. Tests of timber specimens treated with various preservatives for protection against marine borers have been continued. Of the 4 org. As compds. tested D. M. (chlorodihydrophenarsazine) and B. D. C. (a mixt. of phenylarsenious oxide and phenylarsenious chloride) were effective against *Teredo* but failed against *Limnoria*. Well-creosoted timber was effective but uniform penetration was difficult to obtain. Seventh series of timber tests for exposure at Colombo. S. M. DRXON. One hundred and twenty pieces of Swedish fir were treated by the Bethell process with creosote and petroleum contg. 5% D. M. or B. D. C.

ALFRED L. KAMMERER

Report of Committee XVII on wood preservation. F. C. SHEPHERD, et al. *Proc. Am. Ry. Eng. Assoc.* 1929, 653-702.—A change in the form of the shield used in creosote distn. is recommended. Addnl. definitions are submitted completing the list of important terms used in the industry. Data of completed service tests of ties, supplementing previous tables are given. The annual table of tie renewals per mile for 26 railroads has been extended to include 1927. A remarkable reduction in renewal requirements due to use of treated ties is shown. Progress reports of exposure tests of treated and untreated wood specimens for resistance against marine borers are described under the following headings: immune timber and mech. protection; Chem. Warfare Services specimens; San Francisco tests; creosote and creosote fractions. A rept. is made on the inspection of 42 railroad bridges of creosoted Douglas fir in service 10 to 32 years, including treatment data and creosote analyses in many cases. A. L. K.

Report of Committee 4 on preservatives. W. H. FULWEILER, et al. *Proc. Am. Wood Preservers' Assoc.* 1929, 43-66.—Revision of Manual: The standard specification for preservative oils for non-pressure treatment has been revised; a new specification for anthracene oil is presented for adoption as standard; the clause referring to dehydration in the standard method for the distn. of creosote has been revised. Tables prepd. by the Bureau of Standards of factors for correcting the vol. and sp. gr. of creosote oils for different temps. are presented for adoption as standard. A study of the precision and tolerances of the existing standard methods of analysis of creosote of the Assoc. was made. A mathematical and graphical analysis of the data is given. Large differences in the results obtained by different workers are shown to exist as a result

of the coöperative test and further work will be done toward reducing these differences.

ALFRED L. KAMMERER

Toxicity of water-soluble extractives and relative durability of water-treated wood flour of western red cedar. A. M. SOWDER. *Ind. Eng. Chem.* 21, 981-4(1929).—Finely ground samples of heart and sap western red cedar, *Thuja plicata*, kiln-dried and unseasoned, were extd. with hot and cold water. The toxicities of the exts. were tested by the Petri dish method with *Leninus lepidus*. Various concns. of the extractives with malt-agar were inoculated with the fungus. Toxicity tests of the extd. wood were also made with the same fungus. The heartwood exts. and the hot-water exts. were more toxic than the sapwood exts. and the cold-water exts. resp. Kiln-drying temps. have some influence in releasing chem. deposits contained in the heartwood. The effect on toxicity is slight, however.

ALFRED L. KAMMERER

Heat conduction problems (GRIFFITHS) 2. The affinity of Al for O (DE BIRAN) 6. Cement (Fr. pats. 658,727 and 659,743) 18.

HENTRICH: **Teerstrassen.** Halle (Saale): Wilhelm Knapp. 53 pp. Paper, M. 2.80; bound, M. 4.40. Reviewed in *Chimie & industrie* 22, 223(1929).

JURGEL, P.: **Die Herstellung der Klinker, insbesondere der Pflasterklinker.** Berlin: Tonind.-Ztg. 42 pp. Reviewed in *Chimie & industrie* 22, 224(1929).

Calcining limestone and cement. LOUISVILLE CEMENT CO. Brit. 306,856, Oct. 21, 1927. Limestone or natural cement rock is calcined in rotary furnaces (which are described) while the material and heating gases move in the same direction through the calcining chamber, and a greater depth of material is maintained at the discharge end than at the feeding end of the chamber. A preheating chamber may be used in which the material and gases pass in counter-current.

Apparatus for manufacture of aluminous or other cements by fusion. GEORGES DUMAS (to Soc. anon. des chaux et ciments de Lafarge et du Teil). U. S. 1,728,597, Sept. 17. Structural features are described of an app. comprising a reverberatory furnace and preheating kiln.

Molding cementitious materials. J. C. SEAILLES and SOCIÉTÉ LAP. Brit. 307,638, March 23, 1928. A liquid or pasty cement or lime mixt. or the like is poured into a mold and subjected to rapid successive shocks and vibrations to eliminate air pockets and excess moisture.

Coloring cement. ARNOLD N. P. JACOB. Fr. 658,841, Aug. 9, 1928. Articles molded in Mg cement are colored by dipping them into a soln. of a strongly oxidizing salt such as KMnO₄ or a chromate and then into a soln. of a Co salt.

Rotating cement kiln. G. POLYSIUS. Fr. 658,834, Aug. 9, 1928.

Rotary kiln for burning cement. CARL MÜLLER. Ger. 481,649, Mar. 31, 1928. A furnace in which the cement and fuel are together blown into the firing drum is described.

Rotary kiln for burning cement by the wet method. A. V. JENSEN. Brit. 306,613, Nov. 28, 1927. Structural features.

Rotating kiln for cement, lime, etc. ARTHUR ANKER. Fr. 658,206, Dec. 9, 1927.

Rotary inclined kiln suitable for cement manufacture. MENNO S. PRICK. U. S. 1,727,217, Sept. 3. Structural features.

Rotary tubular kiln suitable for cement manufacture. HOMER L. RANK and HURXTHAL F. FREASE. U. S. 1,727,036, Sept. 3. Radiating devices and a ventilating system are provided for the hot zone.

Portland cement. POVL T. LINDHARD (to F. L. Smidth & Co.). U. S. 1,728,496, Sept. 17. Cement material is ground to standard cement fineness, the temp. of the material is reduced below that at which the heat added in subsequent grinding would raise the temp. of the material above the crit. degree of change of quality, and the material is then ground to special cement fineness. App. is described. U. S. 1,728,495 describes a mill for grinding cement.

Portland cement. JEAN J. HENDRICKX (to Soc. anon. établissements Poliet & Chausson). U. S. 1,728,828, Sept. 17. A mixt. of the raw cement-forming ingredients is roasted in a rotary furnace by means of pulverized fuel burning within the furnace and lime is added to the pulverized fuel used, in order to prevent undesirable alterations in the compn. of the cement produced.

Concrete paving blocks. FRANK S. HONBERGER. U. S. 1,729,256, Sept. 24. Slabs are formed with a lower layer of relatively great d. and little porosity and an upper

layer, monolithic with the lower layer, of relatively greater porosity interstitially impregnated with asphalt.

Waterproofing masonry surfaces. LOUIS S. WERTZ (to The Wertz Co.). U. S. 1,726,600, Sept. 3. A mixt. of finely divided iron, NH_4Cl and water is forced into the voids of the material by use of compressed air.

Artificial stone. W. MAGUIRE. Brit. 307,132, Dec. 16, 1927. Products having the appearance of aged or weathered stone are formed by embedding sol. material such as crystals of MgSO_4 in the surface of a cement compn. during molding and subsequently dissolving this material to leave a pitted surface.

Asphalt paving composition. JAMES S. DOWNARD. U. S. 1,727,231, Sept. 3. A filler suitable for shipment in the granular state without forming a solid mass under normal atm. temps. is prepd. by agitating a fine mineral dust, melted asphalt and hot water sufficient to form a wet paste, drying the paste and breaking it up. Cf. C. A. 23, 1455.

Colored sand. G. H. HADFIELD and SAND & SHINGLE, LTD. Brit. 307,448, Dec. 8, 1927. Sand is mixed with a coloring substance and with sufficient cement to cause the coloring substance to adhere to the particles of sand without forming a solid mass.

Refractory building material, etc. G. KNUDSEN, V. M. GOLDSCHMIDT and R. KNUDSEN. Brit. 307,391, Sept. 3, 1927. In making a product consisting substantially of Mg orthosilicate, as described in Brit. 260,298 (C. A. 21, 3439), the talc is wholly or partly replaced by other Mg hydrosilicates such as serpentine, in forming the reaction mixt. Various other materials may be added; details of procedure are given.

Device for determining dissipation of energy in building materials by elastic hysteresis. OTTO FORPL and EWALD PERTZ. Ger. 470,202, Mar. 23, 1927. Correction of title (cf. C. A. 23, 1489).

Sheet material for roofing or other building construction. J. A. MONTGOMERIE. Brit. 307,144, Dec. 24, 1927. Al foil is cemented under pressure to one or more plies of paper, cardboard, felt or other fabric by an intermediate layer of asphalt, pitch, tar or the like (or a compn. such as the asphalt emulsion described in Brit. 226,032, C. A. 19, 1625).

Transparent roofs. I. G. FARBERNIND. A.-G. Fr. 659,942, Sept. 4, 1928. See Brit. 306,242 (C. A. 23, 5019).

Constructional material. ALBERT C. FISCHER (to The Philip Carey Mfg. Co.). U. S. 1,726,612, Sept. 3. Products such as expansion joints are formed of a mixt. of blown bituminous material and ribbon excelsior of which the bituminous material comprises about 70%. U. S. 1,726,613 relates to expansion joints of similar material.

Composition for expansion joints. ALBERT C. FISCHER (to The Philip Carey Mfg. Co.). U. S. 1,728,114, Sept. 10. A plastic waterproof binder is used with shredded roofing scrap and shredded scrap contg. rubber. U. S. 1,728,115 relates to expansion joint material formed in layers united by an adhesive and each including parallel mats of fibrous material. Cf. C. A. 23, 490.

Impregnating wood. RÜTGERSWERKE A.-G. (Rudolf Schnurre, inventor). Ger. 481,601, May 13, 1927. A method of detg. the absorptive capacity of wood and similar substances for liquids is described.

Apparatus for impregnating paper, wood or other materials with synthetic resins. DANIEL A. L. TEXIER. U. S. 1,729,056-7, Sept. 24. Structural features.

Dyeing standing trees. HERBERT RENNER (to Chemi-color Wood Preserving Co.). U. S. 1,727,939, Sept. 10. Mech. features.

21-- FUELS, GAS, TAR AND COKE

A. C. FIELDNER

Utilization of solid fuels for domestic purposes in Czechoslovakia. E. DVOŘÁK. *Trans. Fuel Conference, World Power Conference, London, 1928* 3, 32-48(1929). Combustion tests of brown coal in stoves under various conditions of firing are described. Admission of addnl. air to the fire space increased efficiency from 57 to 73%. **Appendix.** Mathematical explanation of the conditions of combustion and coordination with experimental results. *Ibid* 48-61.

A comparative study of solid fuel, gas, electricity and oil for domestic purposes. MARGARET FISHERDEN. *Trans. Fuel Conference, World Power Conference, London, 1928* 3, 78-117(1929). From 1918 to 1928 world coal production has been about 1200 million tons per annum. In 1918 this was the source of 85% of the total energy

generated; in 1928 it represented only 75%, oil and natural gas generated 15% and water power 10%. The av. relative costs of potential heat units in different fuels in England are bituminous coal 1.0, anthracite 1.6, gas coke 1.0, fuel oil 1.5, paraffin oil 4.3, gas 5.6, electricity 16.1. The thermal efficiency of the conversion of solid fuel into gas is figured as 50% and of coal to electricity as 13% (basis for these assumptions is given). F. discusses the use and efficiency of different fuels in open fires, closed stoves, heating systems and central stations. In open fires, the efficiencies are: coal 20, coke 25, gas 45 and electricity 75%, resulting in comparative fuel costs for equal radiation of coal 1, coke 0.8, gas 2.5, electricity 4.3. The relative costs of equiv. heat production at the indicated overall efficiency are: central heating by coal (50%) 1.0, coke (50%) 1.0, oil (60%) 1.3, gas (75%) 3.7; stoves with flues using coal (50%) 1.0, coke (55%) 0.9, anthracite (60%) 1.3 and gas (75%) 3.7; and flueless stoves using paraffin oil (100%) 2.2, gas (100%) 2.8 and electricity (100%) 8.0. ALDEN H. EMERY

Domestic heating by means of solid fuel, oil, gas and electricity. I. House heating-boiler efficiency. O. P. HOOD *Trans. Fuel Conference, World Power Conference, London, 1928* 3, 168-73 (1929); see C. A. 23, 1242 for results of 534 tests of 172 coals in domestic boilers. Results of 328 tests by the Dept. of Agriculture using oil burners of several kinds and with different adjustments show wider variations in efficiencies than the above tests with solid fuels and the av. burning efficiencies are about the same.

II. Domestic heating by gas. A. G. KING, E. D. MILENER AND C. G. SEGBLER. *Ibid* 173-206.—The factors involved in house heating by gas, the estns. of gas requirements, the load factors to be expected and the various types of furnaces and their requirements are discussed. The losses of heat from buildings are considered quantitatively and a table showing the d. and cond. of 37 insulating materials commonly used in building construction is given. **III. Utilization of electricity for domestic heating.** H. W. DERRY. *Ibid* 207-29 (1929).

ALDEN H. EMERY

Characteristics for liquid automobile and airplane fuels. WA. OSTWALD. *Petroleum Z.* 25; *Motorenbetrieb u. Maschinen-Schmierung* sect. No. 19, 3-7; No. 24, 5-8 (1929).—General discussion.

A. A. BOEHLINGK

Alcohol mixtures as motor fuels in South Africa. J. G. ROSE AND DUNCAN McMILLAN. *Engineering* 128, 305-7 (1929).—The results of several practical tests are given. An alc. mixt. should contain not less than 25-30% Et₂O, 10-20% gasoline, benzene or similar fuel and less than 1% lubricating oil. A mixt. of 30% alc. (95%), 20% Et₂O and 50% gasoline has been put on the market. If abs. alc. can be manifolded at a low price the use of Et₂O may become unnecessary.

E. SCHOTTE

The use of methanol and ethanol as fuels for internal-combustion engines. LOUIS. *Ann. combustibles liquides* 4, 183-274 (1929).—See C. A. 23, 3789.

R. E. SCHAAD

Influence of fuel on Diesel operation. ROBERT E. BRUCKNER. *Power* 70, 88-90 (1929).—Practical tests on various fuels indicate that many common specifications are irrational. S tolerance is unnecessarily low; the viscosity at a given temp. rather than sp. gr. is important, ignition temp. and time at a stated pressure in air or in O are more important than flash point.

D. B. DILL

Water and sediment in Diesel fuel oil. H. L. KAUFFMAN. *Power* 69, 1004-6 (1929).—Into an accurately graduated 100-cc. centrifuge tube introduce 50 cc. of 90% benzene and 50 cc. of oil. Stopper, mix and hold at 120°F. for 10 min. Whirl for 10 min at 1500 r. p. m. in a centrifuge of 16" diam. from tip to tip of whirling tubes. Repeat until const. readings are obtained. Percentages of sediment and water are read off directly.

D. B. DILL

Report of sectional committee on the classification of coal. A. C. FIELDNER. *Proc. Am. Soc. Testing Materials* (preprint) No. 82, 9 pp. (1929).—The organization of the original committee for the classification of N. American coals is described. Previous systems of classifying coals on the bases of chem., phys. and geological considerations are briefly reviewed. Results in the development of an accelerated "slaking test" indicate that it will probably prove very useful in classifying low-rank coals and lignites. Outlines of the work being undertaking by the different technical committees, methods being investigated, important factors considered and progress to date are given. (Cf. C. A. 23, 1736 and 4324.)

W. W. HODGE

Sampling of coal for export. ANON. *Colliery Guardian* 139, 713-4 (1929).—The proposed specifications of the British Engineering Standards Association for the sampling of coal for export are given in detail. They include methods of taking samples from (a) cars, (b) coal chutes during loading or unloading of ships and (c) from band or plate conveyors, as well as procedures for reducing the gross samples by the hand and riffle methods.

H. L. OLIN

The pursuit of accuracy in coal sampling. CHARLES F. KINGDON. *J. Inst. Fuel* 2, 361-3 (1929).—The sketch of a special sampling rifle is given. J. B. CARPENTER, JR.

Flotation of coal. KICHIRO YAMAGUCHI. *J. Fuel Soc. Japan* (Abstr. Sect.) 7, 126-8 (1928).—Most coal can be concd. by flotation. The pneumatic type cell either with shallow bottom or without porous medium, as the Mackintosh or Forrester flotation app., will be preferred. Coal floats as soon as blue camphor oil is added, while pyrite remains temporarily unaffected. F. I. NAKAMURA

Coal-washing investigations. Methods and tests. H. F. YANCEY AND THOMAS FRASER. *Bur. Mines, Bull.* 300, 259 pp. (1929).—Results of an investigation of the washing characteristics of bituminous coals from many of the important coal-producing fields of the eastern and central States are given. Y. and F. discuss the relation of the structure of the coal bed and the manner of occurrence and phys. and chem. form of the impurities in it to the washability of the coal. A systematic method of testing the washability of coal is described and several methods for estg. efficiency are discussed. The coals easiest to wash have a yield-sp. gr. curve similar in shape to a rectangular hyperbola and show a break or point of inflection; the most difficult give a straight-line curve with no inflection. ALDEN H. EMERY

The treatment of coal. C. H. LANDER. *J. Roy. Soc. Arts* 77, 975-86, 987-1003 (1929); cf. C. A. 23, 3069—Improvements in coking practice are discussed, some of which have been developed at the Fuel Research Station. Low-temp. carbonization also is discussed. H. L. OLIN

Analyses of Iowa coals. H. L. OLIN, R. C. KINNE, N. H. HALE AND J. H. LEES. *Bull. Iowa Geol. Survey* 1929, 19 pp.—Proximate and thermal values of samples from 36 leading Iowa coal mines are tabulated. Mean results on the dry basis are ash 13.6, volatile 42.0, fixed C 44.4, S 4.8%, thermal value 12,045 B. t. u. and unit coal 14,555 B. t. u. The mean value of the ash fusion points which were also detd. is 2027°F. H. L. OLIN

The presence of chlorine in coal. H. TER MEULEN. *Rec. trav. chim.* 48, 938-40 (1929).—On detg. the C, H, O, N and S contents of different kinds of coal results are usually obtained which together differ from 100% by only a few tenths %. An English coal from Yorkshire, however, gave results deviating as much as 1% and it was found that this deviation from 100% was to be ascribed to the presence of Cl. A closer examn. of a large sample showed the presence of 0.195% of Cl which could be extd. with cold and boiling water and 0.2 N HNO₃ (cold) successively while 0.215% of Cl was found in the residue by heating with the Eschka mixt. such as is used for the detn. of S in coal. The total amt. of Cl which is found by successive extns. with cold and boiling water and cold HNO₃ (0.2 N) is also found by extn. with the latter solvent alone and includes the basic and non-basic chlorides while the Cl found by means of the Eschka mixt. probably consists of organically bound Cl. A table is given with the results of the examn. of 22 samples of coal of different origin; the total amt. of Cl varied from 0.03% to 0.33%, the extn. with 0.2 N HNO₃ as a rule only giving traces of sol. Cl. C. F. VAN DUIN

Nitrogen compounds in coal. K. ISHIBASHI. *J. Fuel Soc. Japan* 8, 64; *Fuel in Science and Practice* 8, 384 (1929); cf. C. A. 23, 4045. I. examd. N compds in the phenol ext. of coal and concluded that the N compds. in the residue contribute to the NH₃ formation, while those in the ext. are the source of basic compds. in tar. D. A. R.

Determination of volatile matter in Colorado coals. W. A. MANUEL AND C. B. CARPENTER. *Coal Age* 34, 547-8 (1929). Description of method developed at the Colorado School of Mines. Tabular results for 20 different coals are given. E. J. S.

Underfeed stokers burning Indiana coal show large savings. ANON. *Power* 70, 406-9 (1929).—Attempts to pulverize this coal contg. 12% H₂O, 8% ash and 1% S were unsuccessful. It could be burned on a Taylor underfeed stoker 41 tuyères long with 243 sq. ft. of projected grate area installed in a 7960-sq. ft. Badenhauser boiler. B. t. u. per cu. ft. was 21,700; evapn. per lb. of fuel as fired, 9.3 with an over-all efficiency of 87%. Coal saving is \$40,000 per yr. D. B. DILL

An examination of Goutal's method of estimating the calorific value of coal. R. A. A. TAYLOR AND W. S. PATTERSON. *J. Soc. Chem. Ind.* 48, 105-8 T (1929).—The development of Goutal's formula is briefly reviewed and its theoretical basis discussed. The formula is: calorific value of coal in g.-cals. per g. = $C + aV$, where C = % fixed C, V = % volatile matter and a is a figure which varies with V , the volatile matter content on the "ash-free, dry coal" basis. The values for a and V are tabulated and plotted for coals contg. up to 40% volatile matter. To test the usability of this formula in calcg. heating values of coals expts. were carried out on 18 typical British

coals: anthracite, gas, steam, slack and coking. Proximate analyses of these coals (as analyzed; dry; dry, ash-free) and calorific values as calcd. by Goutal's formula and as detd. exptly. in a bomb calorimeter are tabulated. For 10 of the coals ultimate analyses, calorific values calcd. by Dulong's formula, and characteristic ratios H/C, C/O, C/(H + O), C/[H + (O/8)], H/O and % differences from calcs. by Goutal's formula are given. With the exception of a low-volatile coking coal and a very high-volatile, high-O gas coal the calorific values as calcd. by Goutal's formula approximated results obtained with the bomb calorimeter. The ash content seems to have little effect on the issue. Coals of low O content showed best agreement between calcd. and detd. heating values. Calcs. by Dulong's formula averaged no closer to values detd. by bomb expts. than figures obtained with Goutal's formula based on the more easily made proximate analyses of the coals. Apparently Goutal's method affords a means of calcg. the calorific value of coals not excessively high in O content with a degree of accuracy approximating closely results obtained by the bomb method and so has a useful field of practical application.

W. W. HODGE

Test for measuring the agglutinating power of coal. S. M. MARSHALL AND B. M. BIRD. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 216*, 46 pp. (1929).—The essential facts of 18 methods (published since 1870) for detg. the agglutinating power of coals are arranged in parallel columns and the factors affecting the choice of a procedure are critically discussed. The app., machines and materials for making a proposed standard test are described with drawings and photographs and details of manipulation are given. A very pure silica sand, round grain, screened to pass a 40- and remain on a 50 mesh sieve, is washed with CCl_4 and dried. A fresh coal sample is dried at 105° , allowed to stand 24 hrs. at 21° in an atm. of 40% humidity and then ground to pass a 100-mesh sieve. 22.725 g. sand is stirred with 1 drop glycerol and then 2.275 g. of the coal is thoroughly mixed with the sand. The mixt. placed in a tall porcelain crucible is compressed. Five of the samples in a rack are placed in an elec. furnace at 950° until carbonization is complete. The crushing strength of the coke buttons is detd. in a modified Richle textile machine; better results were obtained by allowing the cokes to stand 24 hrs. between carbonization and crushing. The agglutinating value of the coal is the av. crushing strength of 10 buttons, no 1 of which differs from the av. by more than 10%. Any coal with an agglutinating value over 3500 will make a satisfactory blast-furnace coke; a strongly coking coal (Pocahontas No. 3) should give a value of about 8000. Proximate and ultimate analyses, results of distn. tests with analyses of gases evolved, and computations based thereon are tabulated for 18 coals from widely sepd. fields. Correlations are discussed and shown graphically between the agglutinating values obtained for the coals and the phys. properties, strength and resistance to shattering of the cokes, the chem. constituents of the coals, O, the ratios C/H, C/O, H/O and $\frac{C}{H+O}$ and $\frac{C}{H+O/8}$ and CO and CO_2 in the gases formed in the distn. tests. A good bibliography is given.

W. W. HODGE

Some properties of coal dust and pulverized coal. F. S. SINNATT. *Fuel in Science and Practice* 8, 362-70 (1929).—A study is made of some of the properties of coal which may influence its use as pulverized fuel: m. p. of the ash and its compn., mechanism of combustion of the coal particle, size of the coal particle, and difficulty of grinding.

J. B. CARPENTER, JR.

The spontaneous combustion of coal. ICHIRO MIYAGAWA, M. YAMADA AND J. INABA. *J. Fuel Soc. Japan* 8, 776-800 (1929); English Abstract, *Ibid* 81-5.—By using a modified adiabatic calorimeter (Davis and Byrne, *C. A.* 19, 1339) the authors tested 75 varieties of Japanese coal for temp. rise from 101° to 130° due to oxidation of coal and classified them into three groups according to the time required to reach the above temps. The degree of danger from S. C. (spontaneous combustion) can be forecast by the above classification. By treating the oxidation of coal as a gas reaction the authors developed an equation to show the reaction between the temp. rise and the time required: $\ln k_1 + a(1/T_1) = \ln k_2 + a(1/T_2) = C$, where k_1 and k_2 are velocity constns. corresponding to the absolute temps. T_1 and T_2 , resp., while a and C are characteristic constns. of reaction. The oxidation up to 250° is const. and continuous if a large quantity of the sample is used. The reaction velocity is always proportional to the velocity const. and the following equation is derived: $\ln(d\theta/dt) + a/\theta = C$ or $d\theta/dt = Ke^{-(a/\theta)}$, where θ is the characteristic curve of coal and $K = e^{C-a/\theta}$ can be calcd. from the above equation by substituting the exptl. value of a and K . The time required to take fire spontaneously can be calcd. by $t = (1/K) \int_{\theta_0}^{\theta_1} e^{a/\theta} d\theta$ and the value obtained will coincide with practical experiences. The danger of S. C. in coal mines can be known in advance by tracing the curve shown by the formula, $\int ea/\theta d\theta - \theta$. The liability to

S. C. can not be expressed by the amt. of ozone absorbed by dry coal. The bromine no. is no indication as to the liability to S. C., while the iodine, hydrogen peroxide and chromic acid nos. can be used to a certain extent for the estn. of the liability to S. C. The reagent method can be applied parallel with the method of temp. rise, as it indicates the characteristics of oxidizable components in coal. The results of the expts. are illustrated by 6 curves. F. I. NAKAMURA

A large-scale laboratory apparatus for the low-temperature carbonization assay of coal. N. SIMPKIN, C. G. WOOD, A. DAWE AND W. GIBSON. *J. Soc. Chem. Ind.* **48**, 266-7 T(1929).—A discussion of an earlier paper (*C. A.* **23**, 5027). H. L. O.

Low-temperature carbonization of coal. S. W. PARR. *Ind. Eng. Chem.* **21**, 164-8; *Proc. 2nd Intern. Conference Bituminous Coal* **1**, 54-70(1929).—The changes taking place in coal during successive hrs. in its carbonization by high-, medium- and low-temp. processes are shown in 4 sets of time-temp. curves and are discussed. Four temp. range zones are recognized: to 100°, elimination of moisture; 100° to 300° or 350°, the conditioning zone, marked by condensation of organic constituents carrying hydroxyl and carboxyl groups with splitting off of H₂O and CO₂, but not by decompns. evolving hydrocarbons; 300° to 750° or 800°, the zone for "midtemp. coking"; above 750° the high-temp. coking zone. The importance of control of the time-temp. factors while the coal is in the conditioning zone is emphasized. During this period the resultant heat effect is endothermic, but it changes to exothermic at 300-450° depending on type of coal heated, as the coal passes into the pasty stage. The reasons for defining low-temp. carbonization as up to 500° and for recognizing the range 500° to 750° as a specific "midtemp. coking zone" are given, also the quantities and nature of the products obtained by using these coking processes on different kinds of coal. A graph shows the variation in ignition temp. of coke as a function of coking temp. Drawings show the app. used in detg. the ignition temps. of coal and of coke and the old and new type vertical retorts used for low-temp. carbonization expts. Three photographs illustrate the com. Parr Process exptl. plant (*C. A.* **22**, 2657, **23**, 961) which has been in operation for 1 year, and the cokes produced. The analyses of 6 coals used and com. yields obtained by the midtemp. coking process are tabulated. The theoretical coking time is 3½ to 5½ hrs., gas yield, Illinois type coal 5½ to 6 million B. t. u. per ton; tars, large in quantity, uniform in compn. of sp. gr. 1.1, and contg. a high % of creosote oils. Good cokes having less than 5% volatile matter and comparatively low ignition temps. were produced from each coal processed. W. W. H.

The effect of pre-oxidation on the primary distillation products of coal. V. Examination of the cokes and gases obtained by distillation at 600°. JAS. T. DONNELLY, C. HAMILTON FOOTE AND JOSEPH REILLY. *J. Soc. Chem. Ind.* **48**, 38-40T(1929).—Reference is made to previous work on the distn. of pre-oxidized coal (*C. A.* **22**, 3512). A special 50-cc. gas-sampling tube is described. Analyses showing %, O used in pre-oxidizing the coals, and the % C, H and O (including S, N) in the cokes obtained are tabulated and plotted. A set of curves shows the compn. of the gases collected. The wt. of C remaining in the cokes reached a max. from the sample of coal which had used 12.41% O in pre-oxidation (approx. the O satn. point) and then decreased at a const. rate in coals that had been further pre-oxidized. Analyses of the distn. gases indicate that the effects of pre-oxidation of the coal is gradually to lower their % of hydrocarbons and H and to increase their % of CO and CO₂. In the distn. gases from the unoxidized coal the vol. of CO was greater than that of CO₂; from coal pre-oxidized to just under 20% O the vols. of CO and CO₂ evolved were equal, with further pre-oxidation the vol. of CO₂ became greater than that of CO. VI. Examination of the tars. *Ibid.* 101-5T.—Descriptions and drawings are given for a special retort, purification, absorption and collection trains used in larger scale (*C. A.* **22**, 3511), controlled oxidation and distn. expts. on coal. Three coal samples of 700-800 g. were preoxidized at 190° for 12 to 14 days until the "total O used" was 22.0%, 25.26% and 33.47%. Unoxidized and oxidized coal in 600-g. batches was heated to 600° in a current of purified coal gas. Details of construction of the app., manipulations during expts., especially the collection of the tars, and calcs. involved are given. Two tables present the analyses of the tars: fractions calcd. as % of the total tar, and tar fractions calcd. as % of the original dry unoxidized coal. The latter data are also shown graphically. With a high degree of pre-oxidation the decrease in wt. of tar obtained is very marked; unoxidized coal yielded 10.73% tar, but from a coal where "total O used" was about 1%, the original wt. of the coal the tar yield was only 2.08% of the wt. of the original coal. With increasing pre-oxidation the proportion of light oil (up to b. p. 120°) in the tar increases at approx. the same rate as the "heavy tar" decreases. The % tar extl. by dil. NaOH drops from 22.12% in tar from the unoxidized coal to 7.22% in the tar

from a highly oxidized sample. Apparently the effect of pre-oxidation is gradually to destroy the heavier tar and cause more gas and volatile tar to be formed. W. W. H.

The coal-ash fusion process. KARL BUNTE AND WILH. REERINK. *Gas u. Wasserfach* 72, 832-9(1929); cf. *C. A.* 23, 3792.—The app. previously described by Bunte and Baum (cf. *C. A.* 22, 1457) for obtaining the fusion curves of coal-ash samples has been modified by altering the elec. furnace and reducing the diam. of the ash test piece to 25 mm., requiring 30% less ash. A load of 100 g. on the test piece is now used to insure the app. following the changes in the specimen. These changes have not affected the curves appreciably. Fusion curves for *silicates*, obtained with this app., place them in the following order of increasing m. p.: orthoclase, fayalite, albite, anorthite and labradorite, and do not agree with the values given in the literature. NaCl and Na₂SO₄ addns. to anorthite lowered the fusion point, the former having the greatest effect, but no sintering phenomena were noted. Addns. of Fe₂O₃ and SiO₂ in the proportion of 14.8 to 6.2 will reduce the fusion curve of labradorite nearly to that of fayalite, as will equiv. addns. of fayalite, indicating that the effect of these addns. is to form fayalite in the reducing atm. of the furnace. Ash treated with HCl, thus removing part of the Al₂O₃, Fe₂O₃ and CaO, caused an increase in the m. p., but not always in the softening point; addn. of the constituents removed in this way restored the curve approx. to its former shape. Tests of the ash of 51 German coal samples confirmed the statement of Bunte and Baum that when the fusion curve is smooth, the cone softening and m. ps. agree well with the curve, but ash melts which have a high viscosity show considerable differences between the 2 methods. Intermediate types of curves, showing halting points, are due to intermediate silicate formation, but in general the ash samples can be designated as "melting" or "softening." Few really high-melting ash samples were found which did not show earlier softening phenomena. To illustrate the practical application of this method, the fusion curves of the ash from the various component coals in a coke blend were detd., and from these data, changes in the blend made which resulted in a much higher m. p. for the coke ash. R. W. RYAN

Fly-ash nuisance in textile plant cured by filters. CHARLES D. OWEN. *Power* 70, 131-2(1929).—Flue-gas filters were successful. D. B. DILL

Efficient operation of chain-grate stokers. P. M. SYKES AND H. M. MATSON. *Power* 70, 94-5(1929).—One chart shows % of heat in fuel lost as a function of % CO₂ and of % CO in flue gas and another shows % CO₂ as a function of excess air. D. B. DILL

Efficient operation of chain-grate stokers. E. A. UEHLING. *Power* 70, 416-7(1929); cf. preceding abstr.—The first of the above charts is believed to be incorrect and a revised chart is given. D. B. DILL

Operating experience proves pulverized lignite a satisfactory fuel. V. H. BRAUNIG. *Power* 70, 13-6(1929).—Coal as fired contained H₂O 29.05, C 43.9, H 3.12, O 11.24, N 0.75, S 1.34 and ash 10.6%. Sectional elevation of the most successful boiler is given. D. B. DILL

From coal to gas—a thermal balance. FRITZ SCHUSTER. *Gas u. Wasserfach* 72, 713-8(1929).—Heat balances are given for horizontal chamber, producer and water-gas plants, and for a complete plant, with graphic illustrations of the "divided heat stream." R. W. RYAN

Determining gas-, coke- and by-product-making properties of coal. JOSEPH D. DAVIS. *Proc. Am. Gas Assoc.* 1928, 1164-89.—A survey of the methods which are now employed for estg. gas- and coke-making properties of coal with the intention of developing standard methods of evaluation. A. S. CARTER

Coal and coke. R. W. MORRIS. *Mineral Ind.* 37, 84-117(1928).—World production, stocks, trade, prices, consumption, mining, coke by-products and fuel briquets are discussed, with statistics. A. BUTTS

Mechanical mixing of gases and automatic control of heating value. ALAN E. LOCKWOOD. *Proc. Am. Gas Assoc.* 1928, 1352-6.—The Smoot, the Cutler-Hammer and the Roots mixing controls are described, together with a discussion of their success in plant installations. A. S. CARTER

Some aspects of modern gas condensing. J. B. DRABELLE. *Am. Gas Assoc. Monthly* 11, 542-3(1929).—D. discusses gas condensation with special reference to a "shock" tubular system consisting of 216 2-in. tubes, 22 ft. long with a cooling surface of 2517 sq. ft. In operating at 33,600 cu. ft. per hr., the gas was cooled from 181° to 104°F. by means of 88.5 gal. of H₂O per min. at 84°. The characteristics of the system are: no C₁₆H₄ troubles, reduced labor for drip pumping, lower vapor content in gas entering relief holders and heat utilization during the winter to heat storage holders. A. S. CARTER

Gas analysis. E. ORR. *Gas u. Wasserfach* **72**, 862-3(1929).—A new form of gas analysis app. is described which depends on the detn. of H by burning over CuO at 270-290° and CH₄ at a bright red heat, giving more accurate results than combustion or explosion methods. CO is detd. in an I₂O₅ pipet. A rather large manifold bore is used, and this is filled with N before the analysis. A modified form of this app. consisting only of a P pipet, a caustic potash pipet, and the Cu oxide tube with burner and furnace, is used to det. the inerts, CO₂ and N, in the gas. R. W. RYAN

Accuracy of gas measurements and analyses. A. SCHNEIDER. *Gas u. Wasserfach* **72**, 829-32(1929).—Computations of the heating value of gas from gas analyses may be inaccurate by as much as ± 200 cal. per cu. m. Conditions are given for accurate measurement with the Junkers Calorimeter. The errors should not exceed $\pm 1/2\%$. The Union Recording Calorimeter should be accurate to ± 40 cal. for gases varying from 3000 to 5500 cal. per cu. m., while portable calorimeters of the Strache-Kling type should not have errors exceeding $\pm 1\%$. The sp. gr. of gases can be detd. with the modified Bunsen-Schilling app. with an accuracy of ± 0.002 , and with the Union Gas Density Recorder to within ± 0.02 , while the Lux Balance must be calibrated for the given conditions. All methods of detg. H₂S are inexact, even the volumetric detn. with I soln. and Na₂S₂O₃ gives high results because of absorption of I by unsatd. compds. A new method will be announced soon which will give more accurate results. O can be detd. volumetrically over alk. pyrogallie acid or Cr acetate soln., the latter being preferred, with an accuracy of 0.02 vol. %. Naphthalene may be detd. by passing the gas through picric acid, collecting the ppt., hydrolyzing with water and titrating directly with alkali or by treating with KI-KIO₃ soln. and titrating the liberated I with 0.02 N Na₂S₂O₃. Quantities of naphthalene as low as 0.2 g. per 100 cu. m. can be detd. in this way. R. W. RYAN

The control of heating value of industrial gas. H. LOFFLER. *Z. Kompr. u. Fluss. Gase* **28**, 17-20(1929); cf. C. A. **22**, 1160. A portable gas explosion calorimeter is described. R. L. DODGE

Thermal treatment of natural gas. D. S. CHAMBERLIN and E. B. BLOOM. *Ind. Eng. Chem.* **21**, 945-9(1929).—The aromatic hydrocarbons, principally benzene, naphthalene, anthracene, along with acetylene, ethylene and the olefins, were formed from natural gas by thermal treatment at temps. under 900°. As much as 40% of benzene per 1000 cu. m. of gas was produced. C formed in the treatment tubes is responsible for the specific catalytic effect in this transformation. Its activity is destroyed by partial oxidation or the formation of C metal compds. Cu tubes gave the max. yields at the min. temp. but were quickly destroyed. Silica tubes gave high yields at intermediate temps. and were stable. ALLEN H. EMERY

Gas dehydration in relation to the distribution of manufactured gas. LOUIS A. KIRCH. *Proc. Am. Gas Assoc.* **1928**, 1563-4. The dew point of dehydrated gas should not need to be more than 1-2° below the temp. of the system protected. In winter the costs of exceptional cases must be balanced by the savings made possible through complete elimination of freeze-ups. An oil layer on the water in holders maintains a dew point in the gas leaving which is only a few degrees higher than that entering. **Cost of gas dehydration.** G. A. BRAGG, et al. *Fuel* **1929**, 79. See C. A. **23**, 1245. A. S. CARTER

Blue gas vs. producer gas for heating carbonizing units. F. J. PELAKE. *Proc. Am. Gas Assoc.* **1928**, 1112-4. Because of greater efficiency, simplicity and lower costs, the limited data available indicate that producer gas surpasses blue gas in steady operation for the carbonization of coal. A. S. CARTER

The fundamentals of low-grade gas. NORMAN SWINDEN. *Ind. Chemist* **5**, 319-22 (1929).—Gas of 200 B. t. u., as manufd. at Nuneaton, England, is compared with 450-500 B. t. u. gas. The Helph's burner is described, test and the speed of the gas-air mixt. (for complete combustion) necessary to avoid back fire noted. The heat to produce this velocity is calcd., this is much less than for 500 B. t. u. gas. One table and 3 tables. E. G. R. ARDACH

Inspection and maintenance of gas benches. GLENN H. NILES. *Am. Gas J.* **131**, 33-7(1929). E. J. C.

Premature deterioration of gas-meter diaphragms. J. F. ANTHES. *Proc. Am. Gas Assoc.* **1928**, 1579-95.—A review of previous work, together with original expts., has shown the effect of H₂SO₄, NH₃, H₂O, H₂S, S, moist air and gums on vegetable- and chrome-tanned leather. Diaphragms should be constructed from semi-chrome leather contg. at least 3% of Cr₂O₃ (dry grease-free basis), which will withstand immersion in boiling H₂O for 5-15 min. A. S. CARTER

Naphthalene deposits in indirect primary coolers. C. R. LOCKE. *Proc. Am. Gas*

Assoc. 1928, 1153-5.—Two methods of overcoming $C_{10}H_8$ stoppages in the primary coolers of coal-gas plants are discussed.

A. S. CARTER

Vocational sickness (in the gas industry). W. LEYBOLD. *Gas u. Wasserfach* 72, 825-6(1929).—Attention is called to the danger of benzene-vapor poisoning from leaky light-oil or benzene lines and contact poisoning by tar and similar materials. Chronic CO poisoning is rarely observed in gas works. Attention is also called to the danger of H_2S poisoning in connection with $(NH_4)_2SO_4$ plants.

R. W. RYAN

Standards for testing domestic gas ranges and parts. SCHÜTTE AND KÜHNE. *Gas u. Wasserfach* 72, 852-6(1929).—Complete standards and test methods are given for evaluating the efficiency, compn. of combustion products, etc., for gas ranges.

R. W. RYAN

Automatic combustion control improves boiler operation. M. W. HORLEY. *Power* 69, 1043-6(1929).—Without the use of preheaters or economizers an av. of 78% boiler and furnace efficiency is maintained at an av. of 250% boiler rating in burning a mixt. of pulverized and anthracite river coal.

D. B. DILL

A study of the induction tube and its effect upon combustion. H. MISOSTOW. *Power* 70, 484-5(1929).—Details of an induction tube used in a chain-grate installation are given.

D. B. DILL

How operation of horizontal return tubular boilers was improved and smoke eliminated. RUSSELL MELVILLE. *Power* 70, 527(1929).—It is important to stop leaks in boiler setting and to have adequate provision for mixing combustible gases with combustion air.

D. B. DILL

Causes and the reduction of the water content of tar. KARL BUNTE. *Am. Gas J.* 131, 40-3(1929).—See C. A. 23, 1494.

E. C. M.

Water-gas tar production. H. K. SEELEY, et al. *Proc. Am. Gas Assoc.* 1928, 1337-48.—Comm. report on tar separator and water storage design, tar dehydration equipment, waste-water treatment and tar removal from gas and equipment.

A. S. CARTER

Water-gas tar emulsions. L. J. WILLIEN. *Proc. Am. Gas Assoc.* 1928, 1349-51.—W. concludes that tar emulsion difficulties arise from undercracking and recommends higher temps. in the carburetors and superheaters (1500°F.).

A. S. CARTER

A study of low-temperature tars. JAROSLAV TICHY. *Paliva a Topení* 11, 33-7, 41-50, 60-1(1929).—The low-temp tars were produced in a rotating retort (25 kg. capacity) whose condensation chambers were improved by introducing a rotating tar separator. The last condensate was taken up in tetrahydronaphthalene to obtain the lightest hydrocarbons. A const. pressure of 10-5 mm. was maintained. About 30-40-kg. lots were prepd. Dust and H_2O were removed with Sharples supercentrifuge (42,000 r. p. m.) leaving a pure tar. Seven Bohemian coals were coked in the above retort with a continuous and regular evolution of vapors. The gases began to appear at 270-300° as CO_2 , H_2S , C_2H_6 , CO , H_2 , CH_4 and N_2 . The fraction boiling below 200° is large because of good condensation of the tar; fractions boiling below 240° yield oils of a low viscosity; they have a red-brown color, and darken rapidly because of an influence of O and light. The tar of bituminous coal has more paraffins than that from brown coal and has a greater consistency at high temp. The org. bases varied from 0.90 to 2.28% for those sol. in ether and are assocd. with some bases which are insol. in ether. The latter are present in amts. of 0.01-0.20% and yield a characteristic odor after standing in contact with air for a no. of days. They form thick golden-yellow oils. The quantity of "carbon acids" is variable for various coals (0.60-3.92%); they form semicryst., characteristically aromatic oils which increase in viscosity and color upon standing; a small fraction is not sol. in ether. The "carbon acids" were not identified further. Phenols were found in all tars in large quantities which corresponds to the source of the coal and its O content. Phenols which remain sol. in petr. ether are homologs of C_6H_5OH ; the oxidation of the phenols in air forms ulmins, which are insol. in petr. ether. The sp. gr. of the phenols decreased for the low-boiling fractions and increased for the high-boiling fractions. T. considers this due to methylated derivs. with increasing side chains in the low-boiling fractions; in the high-boiling fractions multinucleated compds. of unknown constitution increase the sp. gr. The yield of phenols varied from 6.10 to 23.00%. The low-boiling oils were collected from 0° to 13°. All crude benzenes distd. over had a sp. gr. below 0.8, and were colorless after distn., but all color could be removed with alk. adsorbents. Naphthalene exceeded the quantity of paraffin bases. Neutral oils from coals of a recent geological formation had a high content of unsatd. hydrocarbons; these are considered aliphatic homologs. With H_2SO_4 to which H_3PO_4 was added, polymerizations and sulfonation with subsequent oxidation took place. The max. production of C_8H_8 occurs at 800°, toluene

700° and xylenes 600°. The aromatic hydrocarbons were represented by anthracene, naphthalene and benzene derivs.; benzene was usually absent. FRANK MARESH

Thermic behavior of the phenols and bases of brown-coal tar. S. RUHEMANN. *Erdöl u. Teer* 5, 455-8(1929).—Phenols in primary tar may run as high as 50%. Their removal is difficult, since they resinify readily upon contact with air. Reduction of the OH group is not commercially practicable because the necessarily sensitive catalyst (active Ni) is too easily poisoned by S compds. Heating to 750° in the presence of quartz, glass or pumice splits off CO and causes rearrangements of the nucleus. The final products are essentially high-temp. tar and gas. Pyrocatechol and hydroquinone give CO and butadiene. This as the prototype of diolefins with conjugated double bonds is of importance in the manuf. of artificial rubber. It is possible so to control the decompn. of the phenols as to obtain cyclopentadiene. The high-boiling resinous phenols are almost impossible to sep. Their reactions suggest unsatd. side chains. Distd. under vacuum the OH groups split off water with condensation of 2 mols. Cracking of pyridine gave 6-7% by weight of HCN. This amt. may be dangerous in large-scale operations. A dipyrindine forms also, corresponding to diphenyl from the cracking of benzene W. H. STARNER

Evaluation of some new tar-distillation outfits. M. SLADKOV. *J. Chem. Ind. (Russia)* 4, 964-74(1927); *Chem. Zentr.* 1928, 11, 407-8.—The modern tar-distn. processes are compared with special respect to their advantages to the Russian industry. Processes giving anthraquinone, acenaphthene and diphenyl have lost much of their importance, since these compds. are now more available from other sources. Equipments capable of treating from 100,000 to 300,000 tons per year are at the mercy of deliveries from the coke plants. Outfits handling from 25,000 to 40,000 tons are preferable. The distn. processes of Borrmann, Raschig and Ab-der-Halden are reviewed and compared. The preference is given to the last one. ALBERT L. HENNE

Coke. Report of subcommittee on plant tests. J. T. WARD, et al. *Proc. Am. Gas Assoc.* 1928, 1114-20. **Comparison of plant-test results.** T. A. MANGELSDORF. *Ibid* 1121-3.—Comprehensive figures have been reported on 4 different types of carbonizing plants: Koppers-Becker type gas ovens at Utica (I), U. G. I. intermittent vertical retorts, Rochester (II); horizontal through retorts, Lowell (III); and Glover-West continuous vertical retorts, Stamford (IV). Similarity was found among all except IV which probably varied because of steaming to the extent of 12%. The following data were given: heat of combustion of gas (B. t. u. per lb. of coal) I 3245, II 3065, III 3280, IV 3790; gal. tar per ton coal I 12.4, II 11.4, III 11.6, IV 11.6; coke yield, % of coal carbonized, I 70.2, II 70.7, III 68.6, IV 70.0; ratio of heat output (coke, gas and tar) to input as coal, I 92.90, II 92.90, III 92.62, IV 98.20; B. N. H. per ton of coal, I 6.36, II 5.94, III 4.92, IV 3.38. **Coke quality tests from plant carbonization tests.** HORACE C. PORTER. *Ibid* 1124-5.—In addition to I, II, III and IV reports are included on new U. G. I. intermittent vertical retorts—Syracuse (V) and Woodall Duckham vertical retorts at Buffalo (VI), showing but small phys. differences between I, II and V; III and VI gave more breeze and fines (III only slightly), more porosity, lower wt. per cu. ft. and more abrasion; in the M. I. T. boiler test, the decreasing order of ease of ignition was III, VI, II, I, V; in the Bureau of Mines wind furnace, the order was II, I, VI, V, III; III and VI showed higher values (on a wt. % basis) in water-gas generation for steam decompn., C burning in blow and heat returned. **Cokes from various types of plants using Pittsburgh coal.** P. NICHOLLS. *Ibid* 1127-30.—Addnl. data have been given on these test plants, among others the following are of interest with regard to the coke: wt. per cu. ft. (based on II = 100) I 99, II 100, III 88.5, IV 73.4, V 98.5, VI 70.5; pieces per cu. ft. (based on IV = 100) I 80, II 93, III 82, IV 100, V 93, VI 84; ease of ignition (easiest = 100) I 64, II 68, III 70, IV 100, V 77, VI 82; unburned combustibles in refuse (II = 100) I 91, II 100, III 78, IV 50.5, V 84, VI 64 and % total C as CO (actual %) I 18.8, II 16.2, III 16.9, IV 24.5, V 15.9, VI 14.6. In the discussion of this work (*Ibid* 1137-44), the heat (B. t. u.) to carbonize 1 lb. of coal has been calcd., (A) in the retort only and (B) over all, as follows: (A) I 1235, II 1505, IV 1060; (B) I 1689, II 1720, III 1454 and IV 1146.

Coke. Desirable chemical characteristics. J. D. DAVIS. *Proc. Am. Gas Assoc.* 1928, 1048-54; cf. *C. A.* 22, 4233.—Review. **Physical characteristics.** H. M. CHAPMAN. *Ibid* 1055-6.—Phys. uniformity is emphasized. **Preparation.** L. E. KNOWLTON. *Ibid* 1056-64. **Sampling run-of-oven coke.** C. C. RUSSELL and H. J. ROSE. *Ibid* 1071-4.—Screen tests of 130- and 300-lb. samples are very erratic, whereas 1300-lb. samples show good agreement. Because of the segregation of sizes both in the oven and in handling, large representative samples are necessary. With horizontal-retort cokes the product from one or more retorts should be screened. With ovens where

a moving conveyor belt is used to transport quenched coke, the recommended procedure consists in stopping the belt a no. of times, removing; at each stop about 100 lb., shoveling the belt clean over the area removed. If possible, a container may be placed intermittently under the end of the belt and 100-lb. samples taken in this manner. Nine or 10 such samples representing about 3 ovens should be combined and represent a single typical sample for screening. A. S. CARTER

The correlation of the physical and chemical properties of cokes, with their value in metallurgical processes. II. W. T. K. BRAUNHOLTZ, G. M. NAVE AND H. V. A. BRISCOE. *Fuel in Science and Practice* 8, 411-37(1929); cf. *C. A.* 22, 3760.—A comparison of the "Micum" trommel test and the shatter test shows the former to be merely a modified shatter test in which the force of impact alone plays a significant part. The value for the content of volatile matter in coke depends upon the method of testing; volatile matter evolution while most rapid during the first few mins. of heating continues for a half hour or longer. The weights of different cokes occupying 1 cu. ft. vary according to the coal carbonized and carbonizing conditions. The properties of cokes produced in full-size ovens and retorts are compared to illustrate the influence of the method of charging, oven width, carbonizing time, type of oven or retort, position of the coke in the oven, "soaking" after carbonization and blending of coking coal with anthracite. A reliable indication of the coking quality of a coal is obtained on carbonizing 1 to 2 cwt. of the coal in tins embedded in full-scale oven charges. Observations were made of the relative efficiency in a full-size cupola of graded and ungraded coke and of coke made from the same coal under different carbonizing conditions; 3-day runs were made with each coke. Combustibility tests applied to various cokes gave efficiencies corresponding to the melting efficiencies found in full-scale cupola working. Twenty-two tables and 15 illustrations are given. D. A. REYNOLDS

Hardness and structure of coke. R. A. MOTT. *Fuel in Science and Practice* 8, 322-33(1929).—The shatter index may be expressed as that percentage of coke remaining on either 2-in. or on a 1½-in. screen; the latter is generally preferable. The shattering effect upon coke from one large drop is equal to that of a no. of smaller drops of the same aggregate height. Shatter indices (1½-in. screen) of 53 cokes varied from 96.6 to 69.7. A close relationship exists between the shatter index and the no. and definition of the fractures shown by Rose's method of white plaster filling. Large-scale coking tests show that top-charging improves the hardness of coke. A rapid rate of heating may be disadvantageous in coking a high-volatile strongly caking coal. Fine grinding of the coal up to the limit of 1/16-in. mesh increases the hardness of the coke. Crushed slack gives a harder coke than crushed block coal and clean slurry a harder coke than either. D. A. REYNOLDS

Guaranties for coke ovens and test standards. K. BUNTE. *Gas u. Wasserfach* 72, 785-91(1929).—The exptl. detn. of coke-oven ratings is discussed and standards and tolerances are given. R. W. RYAN

Ring feed producer operation at Rochester, N. Y. FRED PFLUKE. *Proc. Am. Gas Assoc.* 1928, 1088-97.—Operation using both U. G. I. vertical retorts and Koppers ovens is described. A. S. CARTER

Methods of operation in use in the producer plant of the Chicago By-Product Coke Company, Chicago, Illinois. C. R. LOCKE. *Proc. Am. Gas Assoc.* 1928, 1098-1111. A. S. CARTER

Progress in coal preparation in 1928 (RICHARDS, LOCKE) 9. Petroleum and petroleum products [including natural gas and natural-gas gasoline] (KNAPP) 22. Protective coatings (CROWELL, SCHULDR) 26. Pitch and its suitability for road building (OBST) 20. Electrical indicating system for indicating the proper proportions of fuel and air for combustion (U. S. pat. 1,729,500) 4. Explosion vent system for gas distribution pipes (U. S. pat. 1,726,940) 1. Hydrocarbons (Fr. pats. 659,583-4) 22. Carbonizing waste wood and peat, etc. (U. S. pat. 1,728,807) 22. Lubricating oils and phenols from coal tar (U. S. pat. 1,726,638) 22. (NH₄)₂SO₄ from gases (Brit. pat. 307,037) 18. Cyanides [from coke] (U. S. pat. 1,727,261) 18.

ARBOLEDAS, JUAN S.: *Estado actual de nuestros conocimientos sobre el carbón*. Madrid: Enrique Teodoro. 232 pp. Ptas. 10.

Fuel. COMPAGNIE GÉNÉRALE DE PRODUITS DE SYNTHÈSE. Fr. 658,643, Aug. 6, 1928. Hydrocarbons corresponding to the general formula C₂H₄ + CH₄ coming from the combustion and distn. in a gas producer or like app. are polymerized for the pro-

duction of a fuel by heating to about 80° in the presence of a catalyst having a basis of CeSO_4 . The catalyst is prep'd. by roasting monazite, treating with acid, neutralizing, taking up several times with acid and evap'g., after which the residue added to a soln. of CoSO_4 is electrolyzed.

Fuel. THE BARRETT CO. Fr. 658,673, Aug. 7, 1928. A compn. of mixed pitch is obtained by submitting tar to distn. by direct contact with hot gases from the distn. of coal to obtain a high yield of oils and a residue of relatively hard pitch of high f. p. and low C content and mixing the resulting pitch while still warm with tar to obtain a homogeneous mixt., which is used in a liquid-fuel burner.

Fuel briquet. THOMAS A. LAUGHLIN (One-half interest to Isador Acker). Can. 292,421, Aug. 20, 1929. A briquet consists of asphalt 10 to 15%, pitch 5 to 10%, coal dust 15%, crude petroleum 5 to 10% and remainder peat.

Liquid fuels. I. G. FARBENIND. A.-G. Fr. 659,907, Sept. 3, 1928. Non-detonating fuels are obtained by hydrogenating under pressure tars, mineral oils, carbonaceous suspensions or their distn. or transformation products or coal hydrogenation products along with another carbonaceous liquid capable of completing after its conversion the qualities desired in the final products. Examples are given.

Hydrocarbon fuels. COMPAGNIE INTERNATIONALE POUR LA FABRICATION DES ESSENCES ET PÉTROLES. Fr. 659,672, Dec. 20, 1927. Hydrocarbon fuels are obtained from the gaseous products of the distn. of carbonaceous material by passing the gas through purifiers to remove as much as possible of the org. and inorg. S compds, then over hydrogenation catalysts and finally through purifiers to remove H_2SO_4 formed in the catalytic app.

Light hydrocarbons. JEAN M. F. D. FLORENTIN and ANDRÉ J. KLING. Fr. 659,462, Dec. 15, 1927. Light hydrocarbons are produced from complex products such as tars from low-temp. distn. of coal by the action of heat, H under high pressure, dehydrating catalysts such as those described in Fr. 608,560, substitution catalysts (defined in Fr. 607,155) and hydrogenating catalysts composed either of reduced metal (Fe, Co, etc.) or unstable derivs. such as suboxides, sulfides, nitrites, etc., of multivalent metals (W, V, U, Mn, Fe, Cr, etc.).

Treating hydrocarbon materials of low boiling points. FRANK A. HOWARD (to Standard Oil Development Co.). U. S. 1,727,303, Sept. 3. In prep'g products from hydrocarbons principally in the vapor phase, sep'd. from hydrocarbon gas such as natural gas or refinery tail-gas by absorption in mineral seal oil or other materials, a fraction of relatively low vapor tension is condensed, cooled out of contact with uncondensed vapors and gases, and the uncondensed vapors and gases are compressed and subjected to a rectifying action to obtain a liquefied product of relatively high vapor tension which is then mixed with the fraction previously condensed. An arrangement of app. is described.

Distilling and blending solid fuels. B. LAING and H. NIELSEN. Brit. 307,366, Oct. 4, 1927. Solid fuel is obtained by a distn. process of the kind described in Brit. 276,407 (C. A. 22, 2456), Brit. 287,037 (C. A. 23, 503) or Brit. 287,381 (C. A. 23, 503) in which the coal or similar material is dist'd. in a controlled volume of heating gases the magnitude of which is such as to lower the partial pressure of the volatilizable oils present so that these are driven off at temps. below those at which they normally volatilize; this fuel is blended with raw dist'd., or "partly dist'd." carbonaceous materials, e. g., anthracite duff, and the fuel may be briquetted with metallic ores such as oxide ores of Fe or Cu.

Gasification of solid fuel. HUMPHREYS & GLASGOW, LTD. Fr. 658,744, Oct. 8, 1927. Construction of plant is described.

Gaseous fuel. JEGOR BRONN and CONCORDIA BERGBAU A.-G. Fr. 658,349, July 13, 1928. All the gaseous hydrocarbons are sep'd. from distn. gas by liquefaction and are used either alone or mixed with CH_4 as gaseous fuel, particularly for motor vehicles.

Apparatus for complete gasification of fuel. HUMPHREYS & GLASGOW, LTD. Fr. 659,699, Oct. 8, 1927.

Coal distillation. FABRIQUE NATIONALE DE PRODUITS CHIM. ET D'EXPLOSIFS. Fr. 659,630, Aug. 29, 1928. Carbonaceous materials are mixed with oxidizing substances such as alkali or alk. earth nitrates or carbonates or oxides of Fe or Mn and the mixt. is carbonized. The metallized coke obtained may be used as catalyst for the production of alcs. from the distn. gases, as metallic aggregates for shaft furnaces or as fuel for the production of water gas.

A chamber furnace for the distillation of coal. HEINRICH KOPPERS. Ger. 481,875, May 4, 1928.

Apparatus for the distn. of coal, etc. LEWIS C. KARRICK. Fr. 659,729-30, July 30, 1928.

Destructive distillation of coal, etc. C. C. LARSEN. Brit. 307,021, March 1, 1928. Coal, peat, lignite, etc., are distd. by internal heating in a retort the gases from which are heated in a coil in a furnace and the hot gases then used for heating the fuel in the retort. An app. is described.

Destructive distillation of coal, tar sands, oil shales, etc. H. NIELSEN and B. LAING. Brit. 306,654, Dec. 23, 1927. The material is distd. in a current of hot gas after being preheated to a temp. above that at which the heaviest oil fractions in the vapors are liable to condense (the temp. being in inverse proportion to the quantity of O-contg. constituents in the charge). Various details are given. Cf. C. A. 23, 5034.

Apparatus for distilling volatiles from coal, etc., with a counter-current of hot gas or steam. SOC. DE RECHERCHES ET DE PERFECTIONNEMENTS INDUSTRIELS. Brit. 307,250, May 16, 1928. Structural features.

Column still (with jackets for heating gases) for distilling tar, petroleum, etc. O. ELSTERMANN and A. BAUMHÖR. Brit. 307,243, April 30, 1928. Various structural details are described.

Low-temperature coal-distillation plant. LOW TEMPERATURE CARBONISATION, LTD. Fr. 659,302, April 25, 1928.

Device for pulverizing peat and similar fibrous material. BOHUMIL JIROTKA. Ger. 482,125, Jan. 21, 1923.

Apparatus for drying lignite. MASCHINENFABRIK HARTMANN A. G. and I. G. FARBENIND. A.-G. Ger. 481,924, Sept. 8, 1925. The evapn. of the moisture in dried lignite is effected by a drying app. with a mech. conveyor for the lignite.

Briquets. MASCHINENBAU-ANSTALT HUMBOLT (Robert Ganssen, inventor). Ger. 482,123, Sept. 5, 1925. Addn. to 412,556. Briquets are made from lignite, in which the humic acid and humin content is partly satd. with bases, by mixing with neutral salts of the alkaline or alk. earth metals, drying and pressing.

Apparatus for adding a predetermined charge of pitch to briquets. PRÉPARATION INDUSTRIELLE DES COMBUSTIBLES. Ger. 481,923, May 29, 1927.

Montan wax. I. G. FARBENIND. A.-G. Brit. 307,111, Dec. 3, 1927. Chlorinated lignite is extd. with aromatic hydrocarbons such as C_6H_6 , toluene, xylene, molten naphthalene, anthracene oil or a mixt. of cumene and naphthalene, with or without alcs., ketones or other org. solvents, the ext. is filtered and is evapd. to dryness. The product may be melted repeatedly to remove all solvent and HCl, or may be purified by use of EtOAc or other solvent. Cf. C. A. 23, 4803.

Gas producer. OTTO MISCH. Brit. 306,614, Nov. 28, 1927; Fr. 659,700, Dec. 6, 1927.

Gas producer and associated apparatus for combustion of the gas produced. JAMES A. BROWN (to Gas Machinery Co.). U. S. 1,728,389, Sept. 17. Structural features.

Gas producer using ligneous fuel. LOUIS M. RICHÉ. Fr. 658,302, June 8, 1928. **Pressure gas producer.** KARL KOLLER. U. S. 1,728,684, Sept. 17. Structural features.

Rotary furnace gas producer. WITKOWITZER-BERGBAU- UND EISENHÜTTEN-GEWERKSCHAFT and RICHARD HEIN. Ger. 481,750, April 18, 1926. Details of construction are described.

Water-jacketed gas producer. WOODALL-DUCKHAM (1920), LTD., and JAMES W. REBER. Ger. 481,749, Oct. 12, 1926. Details of arrangement are given.

Water-gas producer. JULIUS PINTSCH A.-G. Fr. 658,586, Aug. 4, 1928.

Gas-producer operation. S. I. R. I. SOC. ITALIANA RICERCHER INDUSTRIALI. Brit. 306,959, Feb. 29, 1928. A producer is operated at high temp. with a blast of O admixed with steam or CO_2 , and the ash in the form of fine dust is carried away with the gas; its alkali metal and alk. earth constituents are converted into oxides or hydroxides and facilitate removal of CO_2 and S compds.

Gas-producer charging apparatus. MOTORENFABRIK DEUTZ A.-G. Brit. 306,907, Feb. 27, 1928. Structural features.

Alternate operation of gas generators. ALBERT BREISIG. U. S. 1,728,720, Sept. 17. In the operation of an alternately working gas generator combined with a heat accumulator serving during the run as a vaporizer and in which a recuperator serves during the run for superheating the steam and a waste-heat boiler for utilizing the heat of the produced gas during the run, a part of the waste gases leaving the recuperator is passed into the vaporizing accumulator and another part, simultaneously, into the boiler. An arrangement of app. is described.

Apparatus for producing mixed fuel gas. FRANK D. MOSES. U. S. 1,727,892, Sept. 10. The upper portion of a vertical, externally heated fuel carbonizing and gasification chamber is more sharply tapered than the subjacent tapered portion. Various structural details are described.

Drying fuel gases. CHEMICAL ENGINEERING & WILTON'S PATENT FURNACE CO., LTD., T. O. WILTON and J. PARKER. Brit. 307,600, Feb. 10, 1928. The gas is passed first through hygroscopic substances such as CaCl_2 and H_2SO_4 and then through packings (such as pumice stone and magnesite or calcite) to retain any suspended liquid and deleterious fumes.

Oxidation of natural gas. EDWARD H. BOOMER (to the Governors of the University of Alberta). Can. 291,411, July 16, 1929. Natural gas is oxidized to MeOH and CH_3O and other alcs. and aldehydes by mixing 1 g. atom of O to each g. mol. of hydrocarbon in the gas and heating under 60 to 300 atm. to 250° to 500° in presence of a catalyst.

Gas purification. UNION CHIMIQUE BELGE. Fr. 658,226, July 27, 1928. Coke-oven and like gases coming from the tar and ammoniacal liquor condensation plant are washed with a soln. made alk. by absorption of anhyd. NH_3 . The soln. is used before washing to absorb NH_3 and the acid elements contained in the vapors from the distn. of the ammoniacal liquors; the anhyd. NH_3 is first used as cooling agent for the gases to condense hydrocarbons.

Gas purification. KALI-INDUSTRIE A.-G. and CARL T. THORSELL and AUGUST KRISTENSSON. Fr. 659,339, Aug. 22, 1928. H_2S is removed from a gas by washing with a suspension of a basic ferric salt in a ferric salt soln. The suspension is obtained by oxidizing a soln. of a ferrous salt, e. g., FeCl_2 , with a strong oxidizing agent, e. g., HNO_3 .

Revivifying gas-purifier waste. SOC. L'AIR LIQUIDE, SOC. ANON. POUR L'ÉTUDE ET L'EXPLOITATION DES PROCÉDÉS G. CLAUDE. Brit. 306,947, Feb. 29, 1928. Carbonated ammoniacal soln. such as results from use in removal of CO_2 from water gas or coal gas is regenerated by heating by indirect contact with the regenerated soln. first to a temp. at which CO_2 is not freed, and then in a rectification process. An app. and details of procedure are described.

Water gas. GAS UND TEER G. M. B. H. Fr. 659,426, Aug. 23, 1928. Water gas is produced continuously by adding the fuel to be gasified in a powd. state to a heated current of gas passing into a preheater and then to a gasifying space. Fr. 659,427 describes a process for obtaining water gas from powd. coal or coke and steam, in which the heat necessary for the formation of the gas is obtained from regenerators heated by the combustion of part of the gas. Cf. C. A. 23, 2278.

Water-gas plant. HUMPHREYS & GLASGOW, LTD. Ger. 481,751, Nov. 22, 1924. Details of arrangement and operation are described.

Removing naphthalene constituents from gases. EUGENE H. BIRD (to Koppers Co.). U. S. 1,729,562, Sept. 24. The gas is passed continuously through a bed of non-reacting solid material such as wood shavings or coke breeze drenched with gas oil or other suitable naphthalene-absorbent liquid and the liquid contg. the naphthalene is discharged from the bed of non-reacting material during the gas flow through it; intermittently, and at long intervals, the bed is drenched with the liquid for a shorter time at a high rate of speed. An arrangement of app. is described.

Gas retort. BAMAG-MEGUIN A.-G. Brit. 307,478, March 10, 1928. The base-plate of the retort is formed with a circumferential flue and off-takes for withdrawing the gases from the bottom of the retort. Various other structural details also are described.

Gas holder (of the vertically movable closure disk type). R. WAGNER. Brit. 307,403, March 6, 1928.

"Tankless" gas holder with a flexible diaphragm at its top. R. W. BROADHEAD. Brit. 307,179, Feb. 8, 1928. Structural features.

Treating low-temperature tar. C. BUNGE. Brit. 306,738, March 27, 1928. Acid constituents are sepd. from low-temp. tar or its fractions by emulsification with water or gas liquor and treatment with a solvent (such as alkali solns., alc. or acetone or a mixt. of alc. and acetone). The process may be carried out in plurality of stages and soap soln. may be added to facilitate emulsification. Cf. C. A. 23, 506.

Bleaching tar. PIERRE J. ALIX. Fr. 659,479, Dec. 16, 1927. Tar is washed repeatedly with a 1% Na_2CO_3 soln. before treatment with the usual bleaching agents.

Dehydrating and distilling tar. T. O. WILTON and CHEMICAL ENGINEERING & WILTON'S PATENT FURNACE CO., LTD. Brit. 307,577, Jan. 10, 1928. The tar is circulated continuously through a plant including a coil still heated to above 300° and

crude tar is added from time to time to make up for that distd. An arrangement of app. is described.

Phenols. G. T. MORGAN and D. D. PRATT. Brit. 307,382, Dec. 6, 1927. Purified phenols are obtained from low-temp. tar or its distillates by salting out the resinous or asphaltic constituents in the alk. ext. of tar or distillate. Numerous details of procedure are given.

Apparatus for cooling coke with gas currents. SULZER FRÈRES SOC. ANON. Brit. 306,933, Feb. 29, 1928. Structural features.

Apparatus for quenching coke in running water. A. H. LYMN, N. J. BOWATER and CHAMBER OVENS, LTD. Brit. 307,204, Feb. 25, 1928. Structural details are described of an app. in which a stream of water serves both to quench the coke and to convey it to a discharge point.

Coke oven. HEINRICH KOPPERS A.-G. Ger. 481,874, Oct. 18, 1927. Details of construction.

Regenerative coke oven with selective heating for the various gases. C. OTTO & Co. G. m. b. H. Ger. 481,881, Sept. 25, 1928 and 481,876, Dec. 23, 1924. Details of arrangement are given.

22—PETROLEUM, LUBRICANTS, ASPHALT AND WOOD PRODUCTS

W. F. FARAGHER

Petroleum as a raw material for chemistry and the chemical industries. LOUIS PINEAU. *Ann. combustibles liquides* 4, 7-17(1929).—See C. A. 23, 3798. R. E. S.

Research and the petroleum industry. ANON. *Petroleum Times* 22, No. 552, 241-2(1927). The Anglo-Persian Company's research lab. at Sunbury-on-Thames is described. J. L. ESSEX

Checking up in the oil refinery. H. J. ZIEGLER. *Natl. Safety News* 20, No. 3, 62, 102-3(1929).—Operation, inspection and maintenance departments of oil refineries are explained by which process equipment is carefully inspected to prevent hazards due to fire, corrosion, chemicals, high temps., high pressures, natural wear and tear, etc. E. J. S.

Designing flash distillation equipment for petroleum refining. R. S. PIROOMOV AND N. E. LOOMIS. *Chem. & Met. Eng.* 36, 472-5(1929).—The use of the true b.-p. curve and single-flash equil. data in the design of a pipe still to handle reduced crude is illustrated by a concrete example. The methods of estg. temps., steam requirements, etc., are illustrated. Calcd. results compare closely with observed in most cases. A method is given for estg. the mol. wt. of a cut by taking 95% of the mol. wt. of a normal paraffin boiling at the temp. corresponding to the 50% off point of the true b.-p. curve for the cut. J. K. ROBERTS

Petroleum and petroleum products. ARTHUR KNAPP. *Mineral Ind.* 37, 442-72 (1928).—A review of the industry, covering production, stocks, trade, prices and technology of petroleum and products; also *natural gas* and *natural-gas gasoline*.

A. BUTTS

Petroleum by-products. ANDRÉ GRAETZ AND PIERRE BURGART. *Tech. moderne* 21, 493-6, 533-8(1929).—A review of the by-products obtained from petroleum.

P. THOMASSET

Interfacial tension measurements in the examination of insulating oils. J. C. EDWARDS. *J. Sci. Instruments* 6, 90-5(1929).—A semi-automatic device is described for obtaining relative values of the interfacial tension between oils and dil. acid solns. Drops of acid, formed under a const.-pressure head, at the end of a capillary tube dipping under the surface of the oil, fall through the oil, making contact on the way between a pair of Pb electrodes. The electrodes are connected through a relay to an automatic counter, so that the no. of drops of the acid formed from a given vol. can be detd., and hence the interfacial tension between the oil and acid soln. The elec. stress between the electrodes was without effect on the results, which were reproducible to within 1.5%. Subject to the elimination of kinetic-energy effects in the formation of the drops, the pressure head was not critical. The method has been applied to a study of the deterioration of oils through heating to 115° in an open vessel. The interfacial tension falls in a curve roughly hyperbolic over a period of 7 days. B. C. A.

Some notes on the drop-weight method for the measurement of surface tension.

ALLAN FERGUSON. *J. Sci. Instruments* 6, 163-7(1929).—Historical notes, with comments on a paper by J. C. Edwards (cf. preceding abstr.). E. replies. J. H. M.

Specific heats of mineral oils. L. M. HENDERSON, S. W. FERRIS AND J. M. McILVAIN. *Ind. Eng. Chem., Anal. Ed.* 1, 148-51(1929).—The Cragoe formula [sp. heat = $(A/\sqrt{d_4^{15}}) + B(t - 15)]$, where A equals 0.425 for paraffin base oils, 0.415 for mixed-base oils and 0.405 for naphthene-base oils and B equals 0.0009 and the Fortsch and Whitman formula [sp. heat = $(t + 670)(2.10, \text{ sp. gr. at } 60^\circ\text{F.})/2030]$ do not agree at elevated temps. The Cragoe formula gives a smaller increase in sp. heat. with rise in temp. than the Fortsch and Whitman formula. The authors have obtained new data by a method which consists in measuring the elec. energy necessary to raise the temp. of a given wt. of oil a definite no. of degrees in a definite length of time. The formula developed is: $c = (Q_1 - Q_2)t/(m_1 - m_2)\Delta T$, where Q_1 and Q_2 are the elec. energy inputs in cal. per sec. for paddle and barrel stirring, t is time in sec. for temp. of oil to rise ΔT° , m_1 and m_2 are the wt. of liquid charged in g. and c is av. sp. heat of the oil over the temp. range ΔT . The method obviates the use of a liquid of known sp. heat for detg. the calorimeter const. and avoids the necessity of ascertaining cooling curves for detg. heat losses. The heat of stirring is negligible. For a temp. range of 25-250° the exptl. data agree with the Fortsch and Whitman formula but the sp. heat varies with the type of crude oil, the paraffinic oils showing a higher sp. heat than the naphthenic oils, which is in agreement with Cragoe. The Fortsch and Whitman formula is applicable for all engineering calcs. J. L. ESSEX

Artificial aging of turbine oils. REINHOLD SCHMIDT. *Z. angew. Chem.* 41, 1197-1201(1928).—In order to predict the stability of turbine oils under technical conditions it is essential that any artificial aging (oxidation) expts. be conducted in the presence of metallic catalysts, as the presence of metals is an important factor revealing differences of behavior of apparently similar oils. The following test is advocated: 125 g. of oil oxidized by a slow stream of O (2 bubbles per sec.) in a 250 cc. flask immersed in a boiling-water bath; the catalyst is introduced in the form of a piece of Cu foil (40 × 50 × 0.5 mm.) superficially oxidized and bent to the form of a cylinder. After 70 hrs. of oxidation the oil is tested for acidity and tarry and asphaltic matter. B. C. A.

Method of distillation for gas oils proposed by the 1927 A. G. A. Chemical Committee. ANON. *Proc. Am. Gas Assoc.* 1928, 1281-4; cf. *Ibid* 1265-7.—Methods of testing gas oils adopted by the A. S. T. M. (1928) have been accepted by the A. G. A. Chem. Comm. with the exception of the distn. method (serial D158-28). The proposed method involves the following: *flask*—bulb diam. 86 ± 1.5 mm., inside neck diam. 22 ± 1.0 mm., inside tubulature diam. 10 ± 0.5 mm., neck length 43 ± 1.0 mm., top of neck of tubulature 25 ± 1.0 mm., tubulature length 220 ± 5.0 mm., angle of tubulature 73 ± 1.0°; *condenser*—air-cooled, tapered glass, outside diam. of small end 12.5 ± 1.5 mm., of large end 28.5 ± 3.0 mm., length of taper 100 ± 5 mm., length overall 360 ± 4.0 mm.; *shield*—A. S. T. M. lined with asbestos; *thermometer*—A. S. T. M. high distn.; *sample size*—100 cc.; *distn. rate* 3-4 cc. per min.; otherwise the method and procedure are substantially the same. A. S. CARTER

The centrifuge in oil purification. WALTER B. KEIGHTON. *Power* 70, 483(1929).—Gravity and pressure oiling set-ups are described. D. B. DILL

Committee D-2's work on oil tests. T. A. BOYD. *Natl. Petroleum News* 21, No. 32, 80(1929).—Report of Sub-Comm. VII on S detn. and differentiation. Analyses made by different labs. on com. motor gasolines and on motor gasoline contg. CS₂ are given. J. L. ESSEX

Committee D-2's work on oil tests. FLORUS R. BAXTER. *Natl. Petroleum News* 21, No. 33, 86(1929).—Report of Sub-Comm. XXIII on C residue. J. L. ESSEX

Committee D-2's work on oil tests. HAROLD FARMER. *Natl. Petroleum News* 21, No. 35, 74(1929).—Report of Sub-Comm. XI on turbine oils. J. L. ESSEX

Dew point of gasoline-air mixture defined. R. E. WILSON. *Natl. Petroleum News* 21, No. 31, 70(1929).—The dew point of a gasoline-air mixt. is the temp. at which it just begins to form liquid droplets on slowly cooling a completely vaporized mixt. The term dew point of gasoline is indefinite unless it refers to a particular proportion of air with gasoline; e. g., 12 to 1 mixt. for av. manifold conditions or a 16 to 1 mixt. for theoretically complete combustion. J. L. ESSEX

Performance of gasoline in engines. A spectroscopic study of combustion in the engine cylinder. WALTER C. THEE. *Oil and Gas J.* 28, No. 12, 46, 158, 160, 161(1929).—A continuous spectrum from 4500 to 2800 Å. U. was given by straight-run motor fuels burning under detonating conditions. With C₆H₆ as the motor fuel, with no detonation, the same spectrum appeared. When the straight-run fuel was burned

under non-detonating conditions, no continuous spectrum was seen. A band in the ultra-violet, $\lambda 3064$, is undoubtedly due to OH^- rather than to the H_2O mol. The fact that the max. emission of radiations was assoc. with the burning of the mixt. $\text{H}_2 + \text{O}_2$ rather than $2\text{H}_2 + \text{O}_2$ suggests that part of the radiation emitted by the H_2 flame was due to the presence of OH^- .

EMMA E. CRANDAL

Instructions for the legal standardization of thermometers for the Luynes-Bordas instrument (1925 model) for distilling gasolines, heavy mineral oils and fuel oils. ANON. *Ann. fals.* 22, 421-5(1929).

A. PAPINEAU-COUTURE

Instructions for the legal standardization of thermometers for the Luchaire instrument (1925 model of the French Department of Finances). ANON. *Ann. fals.* 22, 426-8(1929).

A. PAPINEAU-COUTURE

Various methods used for taking temperature of gasoline. ANON. *Natl. Petroleum News* 21, No 36, 39-40(1929).—A comparison of the methods used by different refineries is given.

J. L. ESSERX

The variation of the temperature of spontaneous ignition of fuels in the presence of different compounds. A. GREBEL. *Compt. rend.* 189, 90-2; *Génie civil* 95, 110-3 (1929).—The temp. of spontaneous ignition of a fuel (d. = 0.7254 and b. range 45-215°) with the addn. of various proportions of a no. of aliphatic compds., C_6H_6 , $\text{C}_6\text{H}_5\text{NO}_2$, Fe carbonyl and ethyl fluid (50% tetraethyl lead and 50% $\text{C}_2\text{H}_5\text{Br}$), was detd. in a modified Moore app. In small quantities antiknock compds. raise the spontaneous ignition point, while at high concns. they lower it. Iron carbonyl was more effective than ethyl fluid.

ARTHUR FLEISCHER

Process reclaims tank-bottom B. S. W. T. DOHERTY. *Oil and Gas J.* 28, No. 11, 40-1, 138(1929).—The Humble Oil and Refining Co., Houston, Texas, uses "Breaxit," its own demulsifying agent, for treating tank-bottom B. S., in 2 to 5% fresh- H_2O soln. The heated mixt. of B. S. and chemical is pumped through the treater made up of alternating tubular and baffle sections into the gun barrel. Here it is washed with hot brine, which causes the coalescence and sepn. of most of the emulsified H_2O . The process is completed by a 2nd washing with hot brine in the settling tank. The gasoline recovered from the tanks in which the demulsified oil is stored alone pays the cost of reclaiming, about 9 cts. per bbl. The oil recovered represents profit. E. E. C.

The compression of refinery and casinghead gases. WALLACE J. MURRAY. *Ind. Eng. Chem.* 21, 917-9(1929).—M describes a method of calcg. the compn. and quantity of liquid and gaseous phases produced in the compression of refinery and casinghead gases.

ALDEN H. EMERY

Airplane fuel and lubricants. C K FRANCIS. *Aeronautical Eng. (A.S.M.E. Trans.)* 1, No. 2, 69-72(1929).—The properties and tests of the most suitable fuels and lubricants for airplane engines are discussed and phys. tests of gasolines are given. Light gasoline produced an increase of 125 r. p. m. above the speed obtained with ordinary gasoline, and travel speed was increased from 5 to 11 miles per hr.

E. I. S.

Universal lubricant of the Naphtetorg corporation. I. A. KRILOV. *Trans. State Inst. Applied Chem. (Moscow)*, No. 10, 69-71(1928).—The tests of a lubricant produced by the Naphtetorg corporation, that retained its viscosity at 50°, proved it satisfactory for lubrication of firearms and cannons.

CHAS. BLANC

Analysis of lubricating oils by distillation in cathodic vacuum. P. ISELIN. *Ann. combustibles liquides* 4, 275-302(1929).—See C. A. 23, 3801.

R. E. SCHAAD

Asphalt. PRÉVOST HUBBARD. *Mineral Ind.* 37, 52-7(1928).—Trade, production and use of asphalt are outlined.

A. BUTTS

Modern methods of treating crude pyroligneous acid. K. N. CEDERQUIST. *Tek. Tid., Kemi* 59, 89-93(1929).—Distn. generally takes too much heat. In the Brewster and Suida methods the AcOH is extd. by a low- or a high-boiling liquid, from which it is sepd. by distn. In the method of isotropic distn. a third substance is added to obtain a mixt., from which the AcOH can be sepd. by distn. without an excessive steam consumption. Ethyl acetate can form if a proper catalyst is used on alc. and dil. AcOH . The ester is easily distd. off.

GERHARD RUBEN

Report on wood preservation (SHEPHERD, et al.) 20. Colloid chemical factors in the formation and breaking of crude oil emulsions (LOTTERMOSER, CALANTAR) 2. Asphalt emulsions suitable for use as paints and waterproofing compositions (Brit. pat. 307,288) 26. Destructive distillation of coal, tar sands, oil shales, etc. (Brit. pat. 306,654) 21. Column still for distilling petroleum, etc. (Brit. pat. 307,243) 21. Apparatus for separating oil from compressed air, etc. (Brit. pat. 306,899) 1. Apparatus for separating oil and gas (U. S. pat. 1,727,733) 1. Condenser suitable for use in oil distillation (U. S. pat. 1,728,284) 1. Oil filter (U. S. pat. 1,728,305) 1.

KAUENHOWEN, WALTER: Die Verwässerung von Erdölfeldern, ihre Ursachen und Bekämpfung. Berlin: J. Springer. 80 pp. Reviewed in *J. Inst. Petroleum Tech.* 15, 493(1929).

Refining petroleum. N. V. DE BATAAFSCHE PETROLEUM MAATSCHAPPY. Fr. 658,639, Aug. 6, 1928. Petroleum and petroleum products, which include "cracking" products as well as liquid SO_2 exts., are refined in 2 stages, first with a dil. acid, whereby basic substances are eliminated free from resin, and then with acid of the usual strength. The liquid from the first stage is a valuable insecticide.

Apparatus (with a vertical shell and superposed horizontal pans) for dehydrating petroleum oils by heating, baffling and sedimentation. VICTOR L. GIBSON. U. S. 1,727,604, Sept. 10. Structural features.

Condenser suitable for use in petroleum distillation. JOHN A. GIBB (to Petroleum Derivatives, Inc.). U. S. 1,727,403, Sept. 10. Structural features.

Purifying petroleum vapors with packs of solid sodium hydroxide. RAYMOND C. WHEELER and PAUL W. PRUTZMAN. U. S. 1,728,156, Sept. 10. The oil vapors are passed through the pack together with sufficient steam to disengage reaction products and the pack is continuously drained.

Separating mixed petroleum vapors. RICHARD W. HANNA (to Standard Oil Co. of Calif.). U. S. 1,729,215, Sept. 24. Vapors such as those formed in the vacuum distn. of lubricating oil stocks are passed, at a temp. below that at which they would be cracked or decomposed, through closed transverse passages within a chamber, a part of the vapors is withdrawn and returned to the chamber, and reflux of the heavier fractions of the returned vapors is obtained by a cooling means; this reflux is reheated in the chamber and partially revaporized by heat supplied by the first mentioned vapors by indirect heat exchange. Reflux residue is withdrawn. App. is described.

Breaking emulsions of petroleum and water. CHARLES FISCHER, JR., and WARREN T. REDDISH (to Kontol Co.). U. S. 1,727,164, Sept. 3. The emulsions are treated with a homogeneous reagent contg. the Na salts of mineral oil sludge sulfonic acids, alc. and a bituminous substance such as a pitch having a m. p. between 35° and 95° , the liquid mass is heated (suitably to a temp. of about $65\text{--}90^\circ$) to effect decompn., and the coalesced oil and water are sepd. U. S. 1,727,165 specifies the use together of a bitumen and an oil-sol. mineral oil sulfonate, in aq. soln. Cf. C. A. 23, 2818.

Hydrocarbons. I. G. FARBERIND. A.-G. Fr. 659,583, Aug. 28, 1928. Valuable hydrocarbons are obtained from mineral oils, tars, etc., or their distn. products, by treating the initial materials preferably in the liquid state with H or gases capable of liberating it, and preferably in the presence of catalysts and at such temps. and pressures that sulfurized and oxygenated compds. are eliminated, then submitting the products to cracking in the absence of H and with or without catalysts.

Hydrocarbons. I. G. FARBERIND. A.-G. Fr. 659,584, Aug. 28, 1928. Valuable hydrocarbons are obtained by treating carboniferous suspensions, tars, mineral oils, etc., or their transformation products with H at high temp. and pressure, preferably in the presence of catalysts, in several steps, each step taking place under a pressure less than that of the preceding one.

Hydrocarbon liquids. STANDARD OIL DEVELOPMENT CO. Fr. 658,889, Aug. 10, 1928. Liquids such as heavy naphtha, kerosene, etc., are sweetened by agitating with litharge and aq. NaOH soln. and submitting the mixt. to an energetic current of air or other gas contg. O and adding small quantities of S during the blowing.

Cracking hydrocarbons. I. G. FARBERIND. A.-G. Fr. 659,906, Sept. 3, 1928. Hydrocarbons such as mineral oils, tars, etc., are converted into products of low b. p. by cracking with or without addn. of H and under such conditions that a carbonaceous ppt. is formed without formation of much gas, and treating the products still charged with the formed deposit, preferably in the liquid state, with H or gases yielding it immediately afterward at a high temp. and under high pressure with or without catalysts. Cf. C. A. 23, 968.

Cracking hydrocarbons. JENKINS PETROLEUM PROCESS CO. Fr. 659,949, Sept. 4, 1928. An app. is described in which a heavy hydrocarbon is carried to cracking temp. under pressure in a heater forming a closed cycle and which contains a group of heating tubes, a cylinder placed above the tubes and a baffle plate tower joined to the upper part of the cylinder, the residual products from the tower being mixed with fresh material and returned to the cylinder.

Cracking hydrocarbon oils. CARBON P. DUBBS (to Universal Oil Products Co.). U. S. 1,729,307, Sept. 24. A stream of the oil under heavy pressure is advanced through

a heating coil in a furnace in which it is heated to a cracking temp. above 425° while under sufficient pressure to prevent destructive distn.; the heated oil is then delivered to an enlarged chamber in which the pressure is released so that destructive distn. is permitted to effect a substantially complete sepn. into vapor and dry coke-like residue; vapors are removed, subjected to refluxing, and insufficiently converted material is returned to the heating coil for retreatment. An arrangement of app. is described. U. S. 1,729,308 specifies treating residual oil, which accumulates in the reaction zone of a cracking process, by passing it to a coking still in which pressure is released; coking is effected in this still by passing superheated steam, as the sole heating agent, through the residual oil in the still. App. is described.

Cracking hydrocarbon oils. A. SAKHANOV and M. TILICHEV. Brit. 307,105, Dec. 2, 1927. Oil is forced through a preheating coil; then through a cracking coil of larger diam. than the preheating coil; the cracked products are led through a reducing valve into an expansion chamber maintained under atm. pressure, where C is deposited. Vapors pass to a dephlegmator through the top of which the crude oil is circulated and thus preheated. App. is described. Cf. C. A. 23, 2390.

Cracking heavy hydrocarbon oils. EDWARD W. ISOM, EUGENE C. HERTHEL and HARRY L. PELZER (to Sinclair Refining Co.). U. S. 1,727,707, Sept. 10. Oil is heated to a cracking temp. under pressure and cracked hydrocarbons are distd. off as formed by injecting hydrocarbon vapors above the cracking temp. and reducing the pressure on the oil while continuing the feed of vapors; a gaseous medium such as superheated steam is subsequently injected at a temp. above the vaporizing temp. of the heaviest hydrocarbon remaining in the residue while discontinuing the feed of vapors. An app. is described.

Apparatus for cracking hydrocarbon oils. H. MAGNUS. Brit. 307,511, March 10, 1928. The temp. of the heating zone is automatically maintained constant by thermostatic devices controlling the supply of raw material to this heating zone. Various structural features are described.

Distilling hydrocarbon oils. JAMES C. RYDER (to Petroleum Derivatives, Inc.). U. S. 1,727,380, Sept. 10. Distn. of liquid hydrocarbons such as crude petroleum without substantial decompn. is effected by heating the material, while flowing in a thin stream having a free surface, under high vacuum. An arrangement of app. is described.

Apparatus (with a heating coil and expansion chamber) for distilling hydrocarbon oils. GUSTAV EGLOFF and HARRY P. BENNER (to Universal Oil Products Co.). U. S. 1,729,035, Sept. 24. The expansion chamber has a removable inner shell which is formed of two halves separable for cleaning.

"Cracking" oils. STANDARD OIL DEVELOPMENT CO. Fr. 658,721, Aug. 8, 1928. A plant is described for "cracking" oils in which the oil is heated to cracking temp. in a worm, the cracked product being transferred at an intermediate part to a fractionating zone, from which the condensed liquid is withdrawn and heated by a source of heat exterior to this zone and brought back to the fractionating zone.

Still (of welded metal plates) for distilling and cracking oils. A. O. SMITH CORP. Brit. 307,566, Dec. 24, 1927. Structural features.

Oil distillation. SIGBERT SEELIG. Fr. 659,129, Aug. 18, 1928. In distg. oil by a bath of metal, the oil is prevented from coming in contact with the walls of the reaction vessel.

Refining mineral oils, etc. AKTIEBOLAGET SEPARATOR NOBEL. Fr. 659,725, July 23, 1928. App. for bringing the oil and a purifying liquid into intimate contact is described.

Refining heavy viscous oils from asphaltic or naphthene base crude oils. THEODORE C. HEISIG (to Galena-Signal Oil Co.). U. S. 1,728,059, Sept. 10. The stock is dild. with naphtha, about 1% of 93% H_2SO_4 is added to absorb water, the acid water is removed, and the relatively dry stock is agitated with about 4% of 98% H_2SO_4 , the reaction product or sludge is drawn off, the stock is mixed with an adsorbent such as fuller's earth or charcoal and the diluent is distd. off while the mixt. is violently agitated in the presence of steam, and the hot oil is filtered.

Emulsifying oils, asphalt, etc. J. R. GEIGY A.-G. Brit. 307,000, Dec. 1, 1927. Fish oil, asphalt, petroleum, coal-distn. products such as pitch or cresol, etc., are emulsified by use of sulfite cellulose lye and colloidal silica, which may be formed from water-glass and HCl or formic acid.

Apparatus for low-temperature carbonization of bituminous and oil-bearing materials. I. G. FARBENIND A.-G. Brit. 306,723, March 9, 1928. An inclined rotary drum is lined with masonry and carries within it a plurality of longitudinally extending tubes through which the material is passed. Various structural details are described.

Carbonizing waste wood and peat, etc. CARL G. SCHWALBE. U. S. 1,728,807, Sept. 17. Materials such as waste wood and peat are thoroughly soaked with a concd. soln. of CaCl_2 , MgCl_2 or other suitable non-oxidizing inorg. acid salt of a metal of the alkali group; a small quantity of a non-oxidizing inorg. acid such as HCl or H_2SO_4 is added, which forms a sol. salt with the added salts, and the mixt. thus prepd. is heated at a pressure of less than 15 atm. until the cellulose-contg. material is carbonized. Products such as $\text{Ca}(\text{OAc})_2$ and MeOH are obtained.

Vertical retort for distillation of shale, etc. ROBERT H. CROZIER. U. S. 1,729,418, Sept. 24.

Apparatus (with a vertical shaft kiln) for distillation of shale or similar materials. GEORGE W. WALLACE (to The S. E. Co.). U. S. 1,728,582, Sept. 17. Structural features.

Oil products. CONSTANTIN CHILOWSKY. Fr. 659,246, Dec. 13, 1927. Gases from the partial combustion of heavy oils with air are led upward through a condenser so that the light oils condense at the top and carry the heavier oils down with them.

Apparatus for making oil gas. ALLEN E. DICKERMAN (to Gasco Power Corp.). U. S. 1,728,400, Sept. 17. Structural features.

Apparatus for mixing or emulsifying bituminous or other materials. H. E. WARSOP and F. W. GOUGH. Brit. 307,607, Feb. 18, 1928. Structural features.

Bituminous compositions. K. WINKLER. Brit. 307,465, March 8, 1928. Drying oils such as linseed or wood oil 5% or more are added to pitches, tars, bitumens and natural or artificial asphalts. The oils may be preliminarily thickened by boiling with 2-5% of metal oxides such as oxide of Fe, Cr, Pb or Mn, with or without a borate, etc., and various solid fillers may be mixed with the products. Brit. 307,466 relates to the use of rubber or rubber latex in prepg. similar compus.

Bituminous materials for tree surgery. HAROLD L. LEVIN (to Flmtkote Co.) U. S. 1,726,708, Sept. 3. The walls of a tree cavity are subjected to the action of an aq. dispersion of normally non-fluid and adhesive bituminous material which is miscible with the moisture and natural juices on the cavity walls and which, on elimination of water, forms a coalesced waterproofing dressing on the cavity walls.

Emulsions. JACQUES H. F. BELLANGER and MAURICE A. P. COLLET. Fr. 658,712, Aug. 8, 1928. Bituminous emulsions are prepd. by sending bitumen and water under pressure to an atomizer in such a manner as to obtain a constant flow of each component.

Column apparatus for condensing, stabilizing, fractionating and dehydrating gasoline. HELMUTH R. ORTO. U. S. 1,728,440, Sept. 17. Structural features.

Apparatus for purifying gasoline (such as that used as a solvent) by filtration and treatment with soda, etc. HERMAN W. KRINER. U. S. 1,728,508, Sept. 17. Structural features.

Bag-filter apparatus for gasoline, varnish, etc. FREDERICK OLSON. U. S. 1,726,758, Sept. 3. Structural features.

Filter for fuel oil, etc. T. V. HEMMINGSEN. Brit. 307,003, March 1, 1928. Structural features.

Oil filter suitable for use with automobile engines. ALBERT CHAMPION (to A C Spark Plug Co.). U. S. 1,727,808, Sept. 10. Structural features.

Lubricating composition. ALBERT L. KLEES (to Combustion Utilities Corp.). U. S. 1,727,109, Sept. 3. A lubricant suitable for various purposes comprises cyclic unsatd. non-benzenoid hydrocarbons in admixture with naphthene and paraffinoid hydrocarbons of similar b.p. range.

Lubricating oils. LEO STEINSCHNEIDER. Fr. 659,697, Mar. 28, 1927. An app. is described for distg. liquid hydrocarbons for the production of lubricating oils in which a large no. of distn. chambers are disposed in series, the pressure in which decreases in the order of their succession, and the temp. of the first is not exceeded in the others.

Lubricating oils and phenols from coal tar. ANTON WEINDEL (to Zeche M. Stinnes.) U. S. 1,726,638, Sept. 3. Primary tar is distd. up to about 240° , benzene is added to the still residue to sep. insol. asphaltic substances from the residue, the insol. materials are sepd. from the benzene soln., the benzene is distd. off from the soln. and the lubricating oil material remaining is treated with a solvent such as acetone, which is miscible with water; water is then added to cause the sepn. of the oil while the phenols present remain in soln.

Purifying used lubricating oils. C. E. FOX. Brit. 306,771, June 1, 1928. The oil is cleansed by passing hot water, which may contain soda, acid or fuller's earth, downward through it. An app. is described.

Magnetic separating device for cleaning lubricating oils. F. R. SIMMS and B. C. JOY. *Brit.* 307,547, Nov. 14, 1927. Structural features.

23—CELLULOSE AND PAPER

CARLETON E. CURRAN

Cellulose. KURT HESS AND CARL TROGUS. *Ber.* 61B, 1982-96(1928); cf. *C. A.* 23, 1118.—Attempts are made to establish relationships between the results of preparative chem. research and x-ray investigation in the sugar group. In the examn. of the diagrams of cellulose it is not valid to assume that the compd. is composed of cellobiose residues. The production of cellobiose from cellulose and dextrose from cellobiose is governed by a completely different chem. mechanism. The fact that dextrose, under the condition of acetolysis, does not pass into cellobiose is not evidence that the latter exists preformed in cellulose. Attempts to interpret the x-ray diagrams of cellulose on the basis of a cellobiose unit are of very doubtful value. Observations on cellulose and its derivs., molten and in soln., indicate that it does not contain glucosidic disaccharide linkings. The disentanglement of the structural factors of cellulose from its x-ray diagram is rendered difficult by lack of knowledge of the corresponding diagrams of carbohydrates of known structure. Numerous diagrams are reproduced. The most striking feature of a comparison of the individual diagrams is the very close similarity between those of biosan, which is certainly a substance of low mol. wt. ($C_{12}H_{20}O_{10}$), and cellulose. It is therefore considered that the mass distribution of the atoms in the mol. of cellulose does not differ widely from that in biosan. The diagrams of dextrose, mannose, cellobiose, maltose and lactose all show a maximal intensity, the identity period of which differs within narrow limits in the individual cases. This intensity corresponds with net-plane distance of about 4.5 A. U. The same intensity is observed with cellulose hydrate and biosan, which hence have a mass distribution in a hydropyran ring analogous to that in known sugars. The same general concordance is noted with β - γ -trimethylglucose, β - γ -triethylglucose, octamethylcellobiose, octaethylcellobiose, trimethylcellulose, trimethylbiosan and penta-acetylglucose. The relatively indistinct interferences of cellulose and its derivs. may be attributed to an arrangement of masses of a glucosan-like complex held together by directed associative forces. The sharpening of the interference lines in the transition from cellulose to biosan depends on the transition from this "diffuse" force to exact O bridges whereby the mass distribution remains approx. the same. The effect of substitution on mass distribution is exhaustively discussed. The noteworthy result is obtained that tri-stearylcellulose gives an x-ray diagram with only one marked ring corresponding with a hydropyran ring instead of the probable thread diagram. Cellulose, which has been cautiously nitrated (13.5% N) and then denitrated by $(NH_4)_2S$, gives only a moderately strong line and thus appears amorphous; when dissolved in ammoniacal Cu soln. and reprecipd., it shows the x-ray diagram of cellulose hydrate. Conclusion: A model with greater mass concn. explains more closely the present knowledge of cellulose than that deduced by Sponsler and Dore (*C. A.* 22, 3291) or by Meyer and Mark (*C. A.* 23, 1263). B. C. A.

The cellulose problem. KURT H. MEYER AND H. MARK. *Ber.* 61B, 2432-6 (1928).—M. and M. discuss further and take exception to some of the results published by Hess and Trogus (preceding abstr.). The formation of a biosan from cellobiose is not proved by the investigations of Hess and Trogus. Furthermore, the described hexacetylbiosan from which they prepd. the so-called biosan is more probably a mixt. contg. among other things an acetylated sugar, probably a tetrasaccharide. The formation of cellobiose from cellulose is in agreement with the structure of cellulose proposed by M. and M. The comparison of certain phys. const., as the rotatory power or the scattering angle of low intensity Debye-Scherrer rings, to prove the chem. identity of compds. is challenged by M. and M. To explain the structure of low-mol. sugars, M. and M. believe that Laue photographs, space lattice diagrams and Weissenberg pictures are of more value than Debye-Scherrer diagrams. The discussion on the splitting of certain cellulose-interferences is not appropriate because of a lack of proof and illustration. H. and T.'s stereochem. model of the biosan corresponds in reality to 1,10-maltose anhydride, the space formula of which has recently been described; and their structural model of elementary cellulose units does not agree with either röntgenographical or chemical knowledge. C. E. HRUBESKY

The manufacture of paper pulp from bagasse. GEO. W. CONNOR. *Proc. Hawaiian*

Sugar Planters' Assoc., 48th Ann. Meeting 1928, pp. 353-65(1929).—The manuf. of paper pulp from bagasse by the Roza process at Tuinucu, Cuba, is described, and the economics of the process are discussed. K. D. JACOB

Equations and factors governing the spinning operation (of rayon). L. H. AMDUR. *Rayon* 8, No. 9, 20, 22, 41(1929).—A brief consideration of the various factors and equations governing the spinning of rayon filaments. CHAS. E. MULLIN

The hollow rayons. CHAS. E. MULLIN AND ROSS M. STRIBLING. *Textile Colorist* 51, 157-60, 231-40(1929).—A review and discussion of the history, development, manuf., properties, uses, literature and patents covering the various hollow rayons such as *Cella*, *Luftseide*, *Nouvelle* and other brands. CHAS. E. MULLIN

The new acetate silk plants. CHAS. E. MULLIN. *Textile Mercury* 80, No 2086; *Silk and Art. Silk Suppl.* 80: 2; *Rayon* 8, No. 8, 7-8, 38-9(1929).—A brief discussion of the various plants now mfg. acetate silk, their finances, connections and production. CHAS. E. MULLIN

Economics of burning bark and waste wood. H. A. HATFIELD. *Paper Mill* 52, No. 23, 44-5, 56(1929); *Paper Trade J.* 88, No. 24, 90-1(1929); cf. *C. A.* 23, 951.—A discussion of the economy resulting from proper treatment of barking-drum refuse by draining, pressing and drying to a moisture content of about 40-5% before sending to the boiler. A. PAPINEAU COUTURE

Survey of the chemistry of lignin. EMIL HEUSER. *Paper Trade J.* 88, No. 21, 75-8(1929).—A review of recent results obtained on the detn. of the constitution of lignin, with bibliography of 55 references (since 1921). A. PAPINEAU-COUTURE

Lignin. P. MARCEL SOUM. *Papeterie* 51, 478-82(1929).—After a brief review of the different types of lignin, analyses are given of these lignins prepd. from the wood of Maritime pine. They were obtained in 5.35-32.30% yields and contained C 63-8, H 5-7, MeO 10.27-18.01, ash 0.41-0.73 and pentosans 0.38-3.20%. A. P.-C.

The viscosity of viscose. II. The structural viscosity of viscose. T. NAKASHIMA. *Kolloid-Z.* 48, 326-8(1929).—Tomihisa's values for the viscosity of viscose solns. have been compared with the values calcd. from the Wo. Ostwald equation, $\eta^0 = k$. The results are in close agreement with the calcd. values except for solns. of high viscosity. Tomihisa's results are included. The thickness of threads spun under different pressures also gave values which were in good agreement with the calcd. values. The reciprocal of the thickness of the thread is indicative of the viscosity since the thread was spun under detd. pressures and const. rate (23 m. per min.). Numerous tables are given to illustrate the conclusions reached. L. L. QUILL

Developments in artificial silk production. A. J. HALL. *Paper, Culture Printer* 61, 331-3; 62, 165(1929). RUBY K. WORTER

Structure of the crystalline part of cellulose (MARK MEYER) 2. Recovering volatile products [in artificial silk industry] (Br. pat. 659,477) 13. Transparent material for use as a "glass substitute" (Brit. pat. 307,462) 18.

REIMANN, R.: *Papier-Prüfungen*. Berlin: Carl Hofmann G. m. b. H., and Verlag der Papier-Zeitung und von Zellstoff und Papier. 256 + 112 pp.; M 10. Reviewed in *Chimie & Industrie* 22, 440(1929).

REMMLER, H.: *Herstellung der Sulfitaue* (Schriften des Vereins der Zellstoff- und Papier-Chemiker und Ingenieure). Berlin: Carl Hofmann G. m. b. H. 129 pp. *Reviewed in *Chimie & Industrie* 22, 441(1929).

Pure cellulose from bagasse of sugar cane. EARNEST C. H. VALET (to Celulosa Hemmer Valet, Soc. anon.). U. S. reissue 17,422, Sept. 3. See original pat. No. 1,630,147 (*C. A.* 21, 2384).

Apparatus for charging cellulose digesters. PER A. FRESK. U. S. 1,729,575, Sept. 24. Structural features

Treating cellulose with lactic acid. HEINRICH REIMANN and ALFONS BAYERL (to I. G. Farbenind. A.-G.). U. S. 1,728,206, Sept. 17. By treating cellulose (suitably in the form of cotton) with lactic acid of about 80% strength, products are obtained which are readily acetylated with Ac_2O .

Liquid treatments of foils of cellulose or its derivatives. KURT BRATHING. U. S. 1,728,471, Sept. 17. Foils such as those made from solns. of viscose are placed, while in a permeable state, on a permeable tape; a differential pressure toward the tape is exerted on the foil, and fluids such as water or other washing liquids are applied to the face of the foil exposed to higher pressure. App. is described.

Cellulose solutions. I. G. FARBENIND. A.-G. Fr. 659,783, Aug. 30, 1928. Ammoniacal CuO solns. of cellulose are obtained by dissolving the cellulose in the dry state, without previous swelling, in the ammoniacal CuO. Cf. C. A. 23, 1268.

Nitrocellulose solutions. W. J. JENKINS and IMPERIAL CHEMICAL INDUSTRIES, LTD. Brit. 307,085, Aug. 26, 1927. Solns. for use in coating compns., etc., include ethers such as the Me, Et, Pr, Bu and Am ethers of isobutylene glycol, α , λ -dihydroxybutane or β , γ -dihydroxybutane, together with various other auxiliary or modifying ingredients. Cf. C. A. 23, 4819.

Cellulose ester solutions. I. B. DE INTROINI (to Ruth-Aldo Co.). Brit. 307,392, March 6, 1928. Solns. such as those of nitrocellulose or of cellulose acetate are rendered less viscous and more homogeneous by adding gall or bile or by use of solvents to which gall or bile has been added.

Cellulose acetate. FABRIEK VAN CHEMISCHE PRODUCTEN. Fr. 658,324, June 27, 1928. A highly acetylated cellulose acetate is prepd. by acetylating the cellulose, using H_2SO_4 or a deriv. thereof as catalyst, until the mol. is completely esterified, destroying the excess of anhydride of the acetylation mixt. and allowing the mixt. to stand until the H_2SO_4 in the cellulose mol. has been replaced by AcOH, after which the acetate may be pptd. by excess of water, washed, dried, redissolved in an appropriate solvent and transformed into artificial silk, etc.

Cellulose ethers. I. G. FARBENIND. A.-G. Brit. 306,857, Oct. 21, 1927. See U. S. 1,694,127 (C. A. 23, 981)

Cereal-straw fiber for making thick sheets suitable for use as insulating board. EDWARD S. SHEPHERD (to Albert D. Stewart). U. S. 1,728,258, Sept. 17. Cereal-straw fibers are cooked with water to loosen the gum-like material while regulating the quantity of water used to prevent use of such an excess of water as would soften the fibers sufficiently to render them slimy and "slow"; the fibers are then dried to remove substantially all the water and such assocd. substances as will be carried off with it, the dried fibers are subjected to a tearing action to reduce the cross sectional width of the individualized fibers while preserving their greatest possible length; they are then incorporated with water and subjected to a beating action, which is regulated to give the greatest possible brushing action and to preserve the length of the fibers; the fibers are then subjected to a further cleansing to remove residual gum-like substances, etc.

Apparatus for making plastic films. HEINRICH HAMPEL. Fr. 659,211, Aug. 21, 1928. Flowing app. for making films, particularly from viscose solns.

Films. SPICERS, LTD. Fr. 659,387, Aug. 21, 1928. Films made from cellulose esters or others after leaving the surface on which they are made are passed through an aq. bath electrically connected to earth. The bath may contain an electrolyte capable of reducing a very thin layer of the film to cellulose, and a softening agent such as EtOH.

Apparatus for making "tubular films" from viscose by extrusion into a precipitating bath. KALLE & Co. A.-G. Brit. 306,851, Feb. 23, 1928. Structural features.

Viscose. I. G. FARBENIND A.-G. Brit. 306,971, Feb. 28, 1928. A small proportion of oxalic acid or an oxalate is added to viscose at any stage of its manuf. and serves to facilitate prepn. of a product of clear bright tint and uniform character.

Viscose products. OSCAR KOHORN & Co. and ALWIN JAGER. Fr. 658,992-3-4-5, Aug. 14, 1928. See Brit. 301,305 (C. A. 23, 4072)

Copper oxide ammonia cellulose solution for making artificial silk by the stretch-spinning process. AUGUST HARTMANN (to American Bemberg Corp.). U. S. 1,728,565, Sept. 17. Cellulose is dissolved in a mixt. comprising pure Cu hydroxide and NH_3 , and Na_2SO_4 is added to the soln. in order to reduce the optimum temp. for spinning.

Apparatus for dry-spinning cellulose acetate. RUTH-ALDO Co., Inc. Fr. 658,826, Aug. 9, 1928

Pumps for spinning artificial silk. LOUIS C. BRUN. Fr. 658,463, Aug. 1, 1928.

Spinning apparatus for artificial fibers with recovery of solvents. LA SOIE DE CHATILLON. Fr. 658,700, Aug. 8, 1928.

Artificial fibers. I. G. FARBENIND. A.-G. Fr. 658,875, Aug. 10, 1928. The spinning nozzles for artificial fibers are placed on an arc of a circle in the spinning bath so that they are at an equal distance from the common guide. Cf. C. A. 23, 4070.

Artificial threads, filaments, etc. COURTAULDS, LTD. Fr. 659,610, Aug. 28, 1928. In washing artificial threads, etc., in the spinning box, vertical rods or a cylinder of metal gauze is placed between the washing spray and the thread. Cf. C. A. 23, 1751.

Artificial silk. THE VISCOSÉ Co. Fr. 659,342, Aug. 22, 1928. In the manuf. of artificial silk from a cellulose soln. a uniform tension is given to the thread during drawing from the coagulating bath by communicating to the thread different linear

speeds at detd. points situated at a certain distance from one another in the path of the thread and maintaining this difference of speed in the successive parts of the thread during their passage over these points.

Artificial silk. INOXI (S. A. R. L.) Fr. 659,472, Dec. 16, 1927. Crêpe effects on artificial silk are increased by totally or partially dehydrating by vacuum or heat the thread as it is spun and treating with mineral salts in aq. soln. or mineral or org. acids capable of preventing rehydration before the twisting operation. Cf. C. A. 23, 4353.

Spinning box for artificial silk. NAAMLooZE VENOOTSCHAP NEDERLANDSCHE KUNSTZIJDEFABRIEK. Fr. 659,835, Aug. 31, 1928.

Artificial silk. DU PONT RAYON Co. Fr. 659,923, Sept. 3, 1928. Means are described to give the desired torsion to silk spun by the "pot-spinning" process.

Artificial silk. CUPRUM (Soc. ANON.). Fr. 660,006 and 660,007, Sept. 5, 1928. Arrangements of spinning centrifuges and spinning nozzles.

Wood pulp. VILLEHAD H. FORSSMAN. Ger. 481,652, Oct. 23, 1921. Wood pulp is molded into the desired shape, pressed, dried and coated with chrome-alum or CH_3O .

Sodium carbonate from waste liquors obtained in pulping wood. FRANCIS G. RAWLING. U. S. 1,728,252, Sept. 17. Waste liquor such as is obtained by pulping wood with Na_2SO_3 and Na_2CO_3 is concd and incinerated to form an ash; the ash is treated with a mixt. of air and steam at a temp. to effect combustion of a part of the C present in the ash, thereby converting the Na sulfide to carbonate and eliminating H_2S ; the resultant ash is dissolved in water to obtain Na_2CO_3 free from sulfide.

Paper. CARTIERA DI SAN GIOVANNI LUPATOTO (S. A.) Fr. 658,640, Aug. 6, 1928. A white cellulose pulp for fine printing and packing paper is made from straw, particularly rice straw, by treating the straw with an acid lye contg. 60-80% of free H_2SO_4 and 40 to 20% of sulfite of Na or Ca, or Ca and Mg, in the proportion of 8-12 of SO_2 for 100 of straw, the mixt. being heated to 100-110° in an autoclave for 4-5 hrs. The waxes and fatty materials in the straw may first be saponid.

Paper manufacture. RUPERT B. DANIELS (to L. L. Brown Paper Co.). U. S. 1,729,571, Sept. 24. Mech. features.

Fourdrinier paper apparatus. ALONZO ALDRICH and EARL E. BERRY (to Beloit Iron Works). U. S. 1,726,973, Sept. 3. Structural features.

Paper-making apparatus. HERMAN L. KUTTER (to Black Clawson Co.). U. S. 1,729,350, Sept. 24. Structural features.

Paper-making apparatus. W. VOITH and H. VOITH (trading as the firm of J. M. Voith). Brit. 306,845, Feb. 25, 1928. Structural details.

Paper-making apparatus. PAUL ERKENS. U. S. 1,727,102, Sept. 3. Structural features.

Flow-control device for paper-making machines. EARL E. BERRY (to Beloit Iron Works). U. S. 1,727,928, Sept. 10.

System for control of pulp supply to paper-making and pulp-refining apparatus. R. MARX. Brit. 306,625, Dec. 1, 1927. An app. is described.

Devices for controlling the moisture content and regulating the feed of pulp in making paper. GEORGE E. MAYO. U. S. 1,726,749, Sept. 3. Structural features.

Paper-pulp beater. W. J. ZIMMERMAN. Brit. 307,645, April 9, 1928. Structural features.

Beater and separator for paper pulp. LLOYD T. MURPHY. U. S. 1,726,756, Sept. 3. Structural features.

Apparatus for beating paper stock. WALTER WERNER (to Noble & Wood Machine Co.). U. S. 1,726,873-4, Sept. 3. Structural features.

Grinding wheel for paper pulp. EDWARD ANDERSON (to Simonds Worden White Co.). U. S. 1,727,389, Sept. 10. Structural features.

Apparatus for maintaining a constant concentration of fluent materials such as paper pulp. T. KALLE. Brit. 307,300, March 3, 1928. The impact of a projected stream of the pulp or like material controls the addn., when necessary, of a diluent liquid. Various structural details are described.

Paper material for bottle hood caps. WILBUR L. WRIGHT (to Oswego Falls Corp.) U. S. 1,728,709, Sept. 17. Single-ply paper material hood caps carry a non-fouling binder comprising a high m. p. quick-setting ingredient, non-adhesive on glass, such as carnauba wax, and an adhesive agent such as paraffin in smaller proportion. Cf. C. A. 23, 2794.

Sizing paper. ALBERT L. CLAPP (to Bennett, Inc.). U. S. 1,727,003, Sept. 3. An aq. soap dispersion of unsaponified waterproofing material such as paraffin is incorporated (suitably with Na resinate) into pulp prior to its formation into paper, together with a substantial quantity of Na silicate, sufficient $\text{Al}_2(\text{SO}_4)_3$ is added to ppt. the

soap and Na silicate, thus forming a voluminous ppt. of Al silicate carrying down and fixing substantially all the dispersed material on the pulp.

Waterproofing paper sacks, etc. A. HOLTER. Brit. 307,005, March 1, 1928. The use of various waterproofing agents is described, *e. g.*, a soln. of glue and soap may be treated with alum before use, or other substances forming insol. reaction products may be used as may also paraffin, tar, oils, etc. An arrangement of app. is described.

Parchment paper. W. HARRISON and BRITISH VEGETABLE PARCHMENT MILLS, LTD. Brit. 307,108, Dec. 3, 1927. Thin paper of good strength and free from pin holes and porous spots is obtained by blending rag pulp or wood pulp and pulp from graminaceous fibers such as esparto, straw or bamboo fiber freed from lignin in proportions up to 25 and 75%, resp., forming the mixt. into paper and parchmentizing with H_2SO_4 . Less than the usual beating is employed.

Colors for paper, etc. JACQUES EHRENWERTH. Fr. 659,155, Aug. 20, 1928. A compn. for mixing colors for colored papers, cloths, mural hangings, etc., is composed of a soln. of an alkali silicate with a salt giving fluidity, such as a chromate or bichromate and glycerol.

De-inking printed paper stock. WM. LEWIS. U. S. 1,727,722, Sept. 10. The material is satd. with a soln. of "washing powder," "lye," water glass and water, and subjected to expression. Cf. C. A. 23, 983.

24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

Gaseous combustion at high pressures. XIII. The molecular heats of nitrogen, steam and carbon dioxide at high temperatures. D. M. NEWITT. *Proc. Roy. Soc. (London)* A125, 119-34(1929); cf. C. A. 22, 3992.—Exptl. data derived from explosions at high initial pressures of H_2-O_2 mixts. diluted with A or N_2 and of $CO-O_2$ mixts. are selected for calcg. the mean mol. heats (C_p) of CO_2 , steam and N_2 . C_p for N_2 over the temp. range 289-2600° to 3000°K. is represented by: $C_p = 4.87 + 0.000387 T$. The av. mean mol. heat of CO_2 is 11.42 at a mean temp. of 3173°K. and of steam, 10.41 at 2816°K. The method of calcn. is illustrated by an example for steam and comparisons with other detns. for N_2 , CO_2 and steam extending over a wide temp. range are shown.

H. W. WALKER

The influence of temperature on the limits of inflammability of alcohols. YANNAOULIS. *Ann. combustibles liquides* 4, 303-16(1929).—As the temp. is raised from 50° to 250° the lower limits of inflammability of MeOH, EtOH and their equi-vol. mixt. decreases almost linearly from 7.5 to 5.9%, 3.8 to 3.05% and 4.25 to 3.7%, resp. The upper inflammability limit of MeOH increases from 24.9 to 36.9% with the temp. change 100° to 200°.

R. E. SCHAAD

Dust explosion hazards encountered by firemen in fighting fires in industrial plants. DAVID J. PRICE. Northwestern Fire School, Univ. of Minn., *Mimeograph* 11 pp., Sept. 20, 1929; cf. C. A. 22, 1687.—After an historical review the dangers of explosions from raising dusts during the fighting of fires is pointed out and remedies are suggested.

CHARLES E. MUNROE

Proceedings of C. W. S. Board on disaster at Cleveland Hospital Clinic. D. C. WALTON, A. M. PRENTISS, E. S. LINTHICUM, J. E. MILLS and H. C. KNIGHT. Govt. Printing Office, *Separate* 104 pp., 1929.—Results are given of a large amt. of exptl. work on decompn. of x-ray films showing the large production of CO and nitrous fumes given off by flameless combustion accompanied by extended historical reviews. The accounts of prior similar occurrences in other hospitals is of special importance. C. E. M.

The affinity of Al for O (DE BIRAN) 6. The determination of trimethylene glycol in dynamite glycerol (BERTH) 27. Explosion vent system for gas distribution pipes (U. S. pat. 1,726,940) 1.

Explosive. JOSEPH M. HESS. Can. 293,104, Sept. 17, 1929. An explosive compn. contains NH_4ClO_4 40, nitronaphthalene 15, $NaNO_3$ 38, wood meal 6 and rosin 1%.

Explosive. GUY A. RUPP (to Trojan Powder Co.). U. S. 1,728,307, Sept. 17. In forming an explosive which is non-dusting, a nitric ester of a carbohydrate such as nitrostarch is suspended in water, and a water-immiscible liquid such as a lubricating oil is stirred with the aq. slurry until absorbed by the carbohydrate ester.

Percussion caps for gun cartridges. W. DICKSON and IMPERIAL CHEMICAL IN-

DUSTRIES, LTD. Brit. 307,560, Sept. 19, 1928. Caps and the like are coated with films of non-explosive esters and ethers of cellulose (applied in soln.), such as cellulose acetate or benzyl cellulose.

Containers for inflammable or explosive substances. G. BOYRON. Brit. 306,974, Feb. 28, 1928. Linings are used which may be of a compn. similar to that of printers' rollers and may be formed from ingredients such as glycerol, gelatin, glue, glucose and treacle. Various details and structural features are described.

25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

Peter Griess, the founder of azo dye chemistry. H. GROSSMANN. *Chem.-Ztg.* 53, 689-90(1929). E. J. C.

Practical matching and recording of colors. WALTER M. SCOTT. *The Melliand* 1, 267-73(1929).—The Munsell system of color notation affords a comparatively simple basis for the scientific selection of dyes for matching shades, and for recording colors for reference. E. R. CLARK

Vat colors for woolens and worsteds. HANS MEYER. *The Melliand* 1, 236-7 (1929).—As compared with the chrome colors, vat dyes for wool materials give better working fiber, piece goods of higher strength and shades of high fastness to light, perspiration and fulling. The vat colors may be applied with important savings of time and steam. For shoddy, the limited attack on the already weak fiber is of special interest. E. R. CLARK

The application of azoic colors to wool. A. E. EVEREST AND J. A. WALLWORTH. *J. Soc. Dyers Colourists* 45, 235-7(1929).—In the production of azoic colors on wool and silk, the naphthols and arylides of hydroxynaphthoic acid are applied by means of a soap soln. without caustic alkali. These compds. under these conditions show decided substantivity for wool, while the affinity for silk is still greater. The use of Na_2CO_3 in the soap soln. increases the affinity for wool. An example of the general method of application and a list of suitable naphthols and bases are given. E. W. CLARK

Dyehouse problems. LESLIE P. RANDALL. *Dyer, Calico Printer* 61, 32-3, 52-3 (1929). RICH K. WÖRNER

Naphthols AS—New ideas on the action of formaldehyde and on substantivity. E. SCHBEL. *Rev. gén. mat. color.* 33, 270-2(1929).—The instability of Naphthol AS and the formation of whitish spots when applied to cotton without the addn. of HCHO to the bath is due to hydrolysis and not to CO₂ alone. Differences in stability occur with variations in substituents in the aryl nucleus and also in their position. The general increase in stability to hydrolysis occurs with increase in acid character. HCHO forms addn. products readily without interfering with the formation of the desired color; coupling taking place between the free naphthol and the diazotized base. Sommer's theory that 2 mols. of the aryl deriv. condense with HCHO to form a methylenebis-aryl compd. of hydroxynaphthoic acid does not explain the action occurring between HCHO in contact with solns. of naphthol and applications of naphtholate on the fiber. The velocity of formation of the HCHO compd. varies for the naphthol used and depends on temp. and concn. A curve is given showing the time required for formation of the HCHO compd. of several of the naphthols in the Naphthol AS series. E. W. CLARK

Dyes derived from cinchomeric acid. JAMUNA D. TEWARI. *J. Chem. Soc.* 1929, 1642-4. - Cinchomeric acid (I), PhOH and SnCl_4 heated at $100-10^\circ$ for 14 hrs. give phenolcinchomeranin, brick-red; it does not m. at 375° ; the EtOH soln. is pale yellow, the alk. soln. bright pink. I, $m\text{-C}_6\text{H}_4(\text{OH})_2$ and H_2SO_4 heated 4 hrs. at $100-80^\circ$, give the resorcinol deriv., orange-red, m. 200° , which is slightly sol. in H_2O with an orange color and green fluorescence; the phloroglucinol deriv., deep brown, m. 270° . Heating I and $m\text{-Et}_2\text{NC}_6\text{H}_4\text{OH}$ 6 hrs. gives the $m\text{-diethylaminophenol}$ deriv., pink, m. 127° ; the $m\text{-phenylenediamine}$ deriv., brown, m. 275° ; its EtOH soln. is yellow with deep green fluorescence; in acids the color is red with a green fluorescence. C. J. WAST

Newest dye- and lake-removing agents. WALTER OOST. *Allgem. Ö.-u. Fab.-Ztg.* 24, 635-6; *Chem. Zentr.* 1928, I, 753.—The use of $p\text{-cymene}$, furfural and CaC_2 as dye and lake removers represents a distinct advance in this field. As alk. dips, (1) NaOH , (2) a mixt. of Na_2SiO_3 , soda water and aq. NH_3 and finally (3) MeOH and aq. NH_3 .

are used. The use of sawdust and powd. pumice as fillers for coating the mass is always advisable. Neutralization with AcOH or dil. H_2SO_4 , depending, on the alkyl of the bath, is recommended.

Colloid chemistry and dyeing. II. III. KARIN SCHULZE. *Seide* 34, 209-13, 247-50(1929); cf. *C. A.* 23, 4823.—Review and discussion.

Textile compounds and dyeing assistants. AUGUST NOLL. *Seide* 34, 242-7 (1929).—Further discussion, see *C. A.* 23, 3572, of wetting-out agents, impregnating compds., thickeners, waxes, dyeing assistants, etc., now found on the market. Analyses and formulas are given.

Dyeing rayon in skeins. M. E. DODD. *Cotton* 93, 1126-8, 1221-2(1929).—Practical. A description is given of the equipment and procedure for dyeing rayon in skeins by machinery.

Simple "ombre" dyeing on rayon. W. BENNETT. *Rayon* 8, No. 7, 44(1929).—Formulas and instructions are given.

Notes on wool dyeing. G. RAEMAN. *Dyer, Calico Printer* 61, 118-9, 138-9, 164-5, 182-3, 219-21, 335-7; 62, 76-9, 130-1, 188-9, 240-1, 309-11(1929).

Dyeing, bleaching, calico printing and finishing in California. GEO. RICE. *Dyer, Calico Printer* 61, 328-9; 62, 12-3, 128-9(1929).

Bleaching, dyeing and etching of horn. WILLY HACKER. *Chem.-Tech. Rundschau* 44, 892(1929).—Bleaching is carried out by treatment with alk. H_2O_2 of not over 0.75% concn. The horn is colored black by a soln. of 20 parts Hg in 50 parts concd. HNO_3 . By changes in concn. colors of bright to dark brown may also be obtained. Dyeing with basic coal tar dyes is also possible in the presence of Pb nitrate. Detailed directions for the dyeing and silvering of the horn are included.

A new apparatus for autographic records of the strength and elongation of textile fibers and yarns. S. G. BAKKER AND N. TUNSTALL. *Trans. Faraday Soc.* 25, 103-8 (1929).—A machine has been constructed which records automatically, on a system of rectangular coordinates, the elongation of a fiber or yarn with const. or changing tension. Errors due to friction of moving parts are eliminated altogether, and all but a very small error in tension, due to inertia, and amounting to not more than 0.2 g. has been eliminated. Some typical records at 90% and at 100% humidity are given. The elongation follows Hooke's law approx. up to a certain point, and then a more rapid elongation with increasing tension sets in.

The sizing of warp threads. J. CLAVEL. *Tiba* 7, 893-7(1929).—A brief description of the prepn. of size, with a no. of formulas.

Softening industrial water for textile purposes. S. R. TROTMAN. *Dyer, Calico Printer* 62, 17-9, 147-9(1929).—The use of base exchanging compds. for H_2O softening, the reactions involved and the advantages and disadvantages of this method are discussed.

Effect of tension in mercerization. J. H. SKINKLE AND W. C. LINDSLY. *Am. Dyestuff Repr.* 18, 515-7(1929).—Expts. on two-ply 20's American cotton reeled off into 80 yd. skeins on 36" reel indicate that: (1) Herbig's conclusion, that increase in tension beyond the amt. necessary to keep the yarn at its original length gives no increase in luster, was not supported by the results on the strength tests or the qual. observation on the luster; (2) the strength of this yarn passed through a min. point at about 800 g. tension; (3) at about this same tension the final shrinkage after drying became greater than the max. shrinkage while wet. An explanation of the above results is offered.

Cuprammonium solution, its preparation, analysis and application in textile microscopic investigations. A. P. SAKOSHCHIKOV. *The Melliand* 1, 883-90(1929).— $CuO-NH_3$ soln. for fiber study is best prepd. by passing CO_2 -free air through 25% NH_3 soln., in contact with Cu foil or wire. Since the dissolving power of the soln. depends upon the Cu content as detd. by titration with standard KCN, analysis is important in comparative work. A convenient rapidity of attack for microscopic study occurs at about 0.55% Cu for cotton, jute and raw bast fibers, whereas solns. contg. about 0.35% Cu are more suitable for purified bast fibers. Specifying the Cu content is far preferable to such vague statements as "freshly prepd. Schwietzer's reagent." Photomicrographs show the effect of $CuO-NH_3$ soln. of specified Cu content on various common fibers.

Soluble pine oil in the textile industry. H. C. MORRIS AND R. H. LITTLE. *The Melliand* 1, 261-2(1929).—The high wetting power of dye liquors, etc., prepd. with sol. pine oil, and the stability and volatility of the latter, give it special value for textile uses.

C. R. FELLERS

H. W. STIEGLER

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RUBY K. WORNER

CHAS. E. MULLIN

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A. K. JOHNSON

E. R. CLARK

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changing humidity (II) can be expressed by the formula: $R = 2.57 \times 10^{-4}(H)^{1.75}$.

MERRILL W. SEYMOUR

Effect of laundering on the life of linens and cottons. M. FORT. *Chemistry and Industry* 48, 805-9(1929).—Much interesting information is given on the effect of various laundry treatments upon linen and cotton fabrics. The tendency of laundries to develop standardized processes, irrespective of the nature of the fabric, places linen under a handicap, since linen is the better fiber and can be cleaned with less movement than can cotton. Numerous laundry practices and their effects are mentioned and discussed.

E. G. R. ARDAGH

Comparative effects of laundering and dry cleaning rayons. GRACE BAKER, RACHEL EDGAR AND KATHERINE CRANOR. *Rayon* 8, No. 12, 7-10, 22-4(1929).—Viscose, cuprammonium and acetate rayons of similar construction were dry cleaned and laundered. The dry cleaning was done by a com. dry cleaner, using gasoline 1 and 24 times but no soap. The laundering was done under home laundering conditions in an A. B. C. washer at 120°F. with $1/2\%$ soap soln for 3 min., 1 and 24 times. Only slight shrinkage, an increase in thickness, and a decrease in ash resulted. In gloss viscose remained unchanged, the Celanese lost in the first laundering only; 1 cleaning did not change it but 24 decreased the gloss and made the fabric slightly yellow. The cuprammonium lost luster in the first laundering and then remained unchanged. In the first cleaning it lost luster and after 24 became slightly yellow. A. R. MACORMAC

European methods of waterproofing fabrics. H. JAEGER. *The Melliand* 1, 253-8(1929).—Recipes and diagrams of app. used in the more common processes.

E. R. CLARK

Wetting-out agents. A. LANDOLT. *The Melliand* 1, 243 8(1929).—Com. names, chem. compn., relative effectiveness and methods of testing are outlined. E. R. C.

Glue and gelatin and their uses in the textile industry. S. R. TROTMAN. *Dyer, Calico Printer* 61, 6-7, 30-1(1929).

RUBY K. WORNER

Drives for Weston centrifugals (HOPFERWIESER) 1. Fast colors on leather (LAMB) 29. Fly-ash nuisance in textile plant cured by filters (OWEN) 21. The adsorption of certain acids by wool (PADDON) 2. Disinfecting power of $HgCl_2$ on wool bearing tuberculous matter (CEREDI) 11C. Composition of the steel for various parts of textile machines (SAKHAROV) 9. Controlling the strength of sulfonated oils (VIANELLO) 27. Fluorescence of coloring matter by Wood's light (SEYEWETH, BLANC) 3. Chemistry of perylene (MASON) 10. The coloring of rubber (MARTIN) 30. Nuclear substitution products of 1-aminonaphthalene-8-carboxylic acid or its inner anhydride [intermediates] (U. S. pat. 1,728,995) 10. Imitation suede leather [from velour] (Brit. pat. 306,693) 29. Removing oils, fats, resins, etc., from fibrous materials (Brit. pat. 307,360) 13.

BRAY, HELEN A.: *Textile Fibers, Yarns and Fabrics*. New York: The Century Co. 236 pp. \$2.50.

LETELLIER, ALBERT: *La teinture et l'impression expliquées par la chimie*. Paris: Librairie Scientifique J. Hermann. Reviewed in *Tiba* 7, 967(1929).

Report of the Council of the Linen Industry Research Association, 1928. Lamberg Co. Antrim: The Linen Industry Research Assn. 24 pp.

SANCHEZ, M. R.: *Química de las materias colorantes naturales y artificiales*. Barcelona: Manuel Marin. 485 pp. Reviewed in *Chimie & industrie* 22, 437(1929).

SANSONE, ANTONIO: *Chimie de la teinture*. 2nd ed. Paris: Librairie Scientifique J. Hermann. Reviewed in *Tiba* 7, 967(1929).

Dyes. I. G. FARBENIND. A.-G. Brit. 306,732, March 21, 1928. Metal compds. (such as the Cr and Cu compds.) of *o*-oxyazo dyes are obtained by treating with compds. yielding the metal, such as the oxide and formate, the azo dyes produced by coupling diazotized nitro- or chloro-*o*-aminophenols or both or their derivs. with *m* phenylene-diamine or its nitro, halogen or alkyl derivs. Several examples are given.

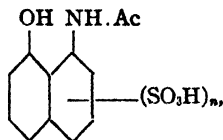
Dyes. I. G. FARBENIND. A.-G. Brit. 306,843, Feb. 25, 1928. Azo dyes obtained by coupling diazo compds. with the methylpyrazolones or pyrazolonocarboxylic acids derived from salicylic sulfones as described in Brit. 245,765 (C. A. 21, 329) are converted into sol. Cr compds. by boiling with Cr salts. The products dye wool fast clear greenish yellow and form good lakes. Several examples are given.

Dyes. I. G. FARBENIND. A.-G. Brit. 306,874, Aug. 22, 1927. Vat dyes giving various blue, violet, gray blue or black shades are produced by alkali fusion of anthraquinonylaminobenzanthrones contg. one or two anthraquinonylamino groups attached

to the benzanthrone nucleus in positions other than the 2- and Bz-1-positions, these two latter positions being either both free or the Bz-1-position being occupied by a 2- or Bz-1-benzanthronyl radical or an etherified hydroxy group while the 2-position is free, or the Bz-1-position is free while the 2-position is occupied by a 2- or Bz-1-benzanthronyl radical. Numerous examples are given.

Dyes. I. G. FARBENIND. A.-G. Brit. 306,963, Feb. 29, 1928. Anthraquinone dyes for wool are made by introducing a CN group into the β -position of an anthraquinone deriv. contg. an arylamino residue in at least one α -position or by introducing an arylamino residue into at least one α -position of an anthraquinone deriv. contg. a CN group in the β -position and sulfonating the resulting base. Several examples are given.

Dyes. I. G. FARBENIND. A.-G. Brit. 307,303, March 2, 1928. Monoazo dyes are made by coupling a diazotized amine of the general formula 2,4,5-YXXC₆H₂NH₂, in which one X stands for an acylamino group, the other X and Y for an alkyl- or aralkyl- or aryloxy- or methyl group (but in any case only one of the symbols X and Y is methyl), with a component of the general formula



in which Ac is an acyl group and n is 1 or 2. The products dye wool from an acid bath clear reddish violet to greenish blue shades. Several examples are given.

Dyes. I. G. FARBENIND. A.-G. Brit. 307,306, March 3, 1928. 5-Amino-4'-acylamino-1,1'-anthrimidocarbazoles, and their derivs. contg. substituents, such as halogen, alkoxyl and OH groups, in the anthraquinone nuclei, are formed by saponifying the corresponding diacylamino compds. "under relatively mild conditions" so that the acylamino group in the 5-position is saponified while that in the 4-position remains intact. The products may be used as vat dyes for dyeing cotton reddish shades or for the manufacture of other dyes. Examples are given.

Dyes. I. G. FARBENIND. A.-G. Brit. 307,104, Dec. 2, 1927. Greenish yellow oil-pigment dyes and size colors are obtained by diazotizing amines such as *p*-aminoacetophenone, *p*-amino-3-nitroacetophenone or *p*-aminobenzophenone and coupling with acetoacetic arylides, the aromatic residues of which may contain halogen as a substituent such as acetoaceticanilide, acetoacetic-*o*-chloroanilide and the like. *p*-Amino-3-nitroacetophenone is formed from *p*-bromo-3-nitro-1-acetophenone by replacement of Br by NH₂.

Dyes. I. G. FARBENIND. A.-G. Brit. 307,150, Dec. 31, 1927. Azo dyes are formed by coupling, in substance or on a substratum, the diazo compd. of 3,6-diamino-7-methoxy-10-(2'-methoxyphenyl)-phenazonium chloride (safranisol) with arylides of 2,3-hydroxynaphthoic acid. The products give violet to black dyeings fast to Cl.

Dyes. I. G. FARBENIND. A.-G. Brit. 307,481, March 10, 1928. Anthanthrone nitriles, which are vat dyes and intermediates for making other dyes, are prepd. from anthanthrone or its derivs. by usual methods; *e. g.*, anthanthrone-2,7-dinitrile is prepd. from the dibromo compd. and dyes cotton reddish orange shades from a violet vat. The mono-, tri- or tetra-bromoanthanthrone and substitution products may be similarly converted.

Dyes. SOC. ANON. POUR L'IND. CHIM. À BÂLE. Fr. 659,526, Aug. 25, 1928. Fast shades on silk and leather are obtained by the use of chromed derivs. of dyes of the triarylmethane series and they may be used in conjunction with chromed azo dyes. Examples are given.

Dyes. SOC. ANON. POUR L'IND. CHIM. À BÂLE. Fr. 659,800, Aug. 31, 1928. Chromed azo dyes are prepd. by dry heating dyestuffs in the presence of chroming agents.

Azo dyes. ALBERT SCHMELZER, FRIEDRICH MUTH and EUGEN GLIETENBERG (to General Aniline Works). U. S. 1,726,681, Sept. 3. A diazo compd. of an unsulfonated monoaminocarbazole compd. such as 1-aminocarbazole is coupled with an arylide of 2,3-hydroxynaphthoic acid, *e. g.*, the *o*-toluidide. Dyes are obtained which give clear fast violet dyeings. Cf. C. A. 21, 5046.

Azo dyes. I. G. FARBENIND. A.-G. Brit. 306,844, Feb. 25, 1928. Azo dyes are formed on the fiber by use as diazo component of a condensation product of a diazo compd. with a secondary base such as piperidine or dimethyl- or diethyl-amine; *e. g.*, cotton may be impregnated with 2,3-hydroxynaphthoic acid- α -naphthalide and de-

veloped by the piperidine compd. of diazotized *m*-nitro-*o*-toluidine which has been treated with HCl and a solubilizing agent or with the piperidine compd. of tetrazotized diisidines similarly treated.

Azo dyes. I. G. FARBENIND. A.-G. Fr. 658,701, Aug. 8, 1928. Fast dyes of red to bluish red shades are prepd. by diazotizing 1-amino-3,4-dimethyl-6-halobenzene and coupling with an arylamide of 2-hydroxynaphthalene-3-carboxylic acid. Several examples are given.

Azo dyes. I. G. FARBENIND. A.-G. Fr. 658,763, May 22, 1928. A new class of azo dyes is obtained by the reaction of any diazo compd. on compds. obtained by condensing 1 mol. of a heterocyclic compd. contg. 2 halogen atoms gradually replaceable, on the one hand with a mol. of an amino-azo compd., and on the other hand with a mol. of a compd. which after the condensation still contains reactive H atoms. The condensation may take place after coupling with the diazo compd. Instead of the condensation products referred to above, compds. may be used in which are found on the heterocyclic ring groups such as $-\text{NHC}_6\text{H}_4\text{NH}_2-$, $-\text{NHC}_6\text{H}_3\text{NH}_2\text{SO}_3-$, $-\text{NHC}_6\text{H}_4\text{NO}_2-$, $-\text{NHC}_6-$

$\text{H}_4\text{NHac}(\text{ac}-\text{C} \begin{array}{c} \text{O} \\ \parallel \\ \text{H} \end{array})$, $\text{COCH}_3\text{COCO}(\text{OH})$ and other azo groups are afterward introduced

into the condensation products after the coupling with the diazo compds. has taken place, as well as after reduction and sapon in detd. cases. Several examples are given.

Azo dyes. I. G. FARBENIND. A.-G. Fr. 659,613, Aug. 23, 1928. Solid azo dyes are prepd. by combining the diazo compd. from 2,4,5-trichloroaniline in substance or on a support with an arylamide of 2,3-hydroxynaphthoic acid. Examples are given.

Azo dyes. I. G. FARBENIND. A.-G. Fr. 659,807, Sept. 1, 1928. New azo dyes are prepd. by combining in substance or on the fiber any diazo, tetrazo or diazo-azo compd., contg. no free sulfonic or carboxylic groups with a *bis*(2',3'-hydroxynaphthoyl)-arylene-1,4-diamine contg. a substituent in the *o*-position with respect to each amino group, the substituents may be identical or not and represent alkyl, hydroxylalkyl or halogen substituents. The *bis*(2',3'-hydroxynaphthoyl)-arylene-1,4-diamines, substituted in the 2 and 5 positions, are new and are obtained by condensing 2,3-hydroxynaphthoic acid or its derivs. with 1,4-arylenediamines, substituted in a corresponding manner. Examples and a list of components with the color obtained are given.

Azo dyes. HENRY DREYFUS. Fr. 659,026, Aug. 14, 1928. Azo dyes are prepd. by diazotizing an anthraquinone deriv. contg. a diazotizable NH_2 group and coupling it with an aminonaphthoic acid or a substitution product thereof. Thus, α -aminoanthraquinone and 2-aminonaphthoic acid give a dye having bluish red shades, 1-amino-4-acetylaminoanthraquinone and 2-aminonaphthoic acid a dye having brown red shades.

Azo dyes. J. R. GEIGY S. A. Fr. 659,734, Aug. 3, 1928. See Ger. 473,526 (C. A. 23, 3350).

Azo dyes. SOC. ANON. POUR L'IND. CHIM. À BÂLE. Fr. 659,267, July 25, 1928. Azo dyes are prepd. by combining diazo compds. with derivs. of pyrazolone obtained by condensation of ester salts of oxalylacetic acid with hydrazine, and, if necessary, treating the dyes thus obtained with metalliferous agents. Thus, 2-naphthylamine 1-sulfonic acid is diazotized and coupled with 5-pyrazolone 3-carboxylic acid, the product dyeing wool in intense yellow shades. Several other examples are given.

Azo dyes on natural silk. KURT WOETZEL and HEINRICH LINT (to I. G. Farbenind. A.-G.). U. S. 1,727,920, Sept. 10. Silk is impregnated with a soln. of an arylide of 2,3-hydroxynaphthoic acid and developed with a diazo soln.

Azo dye containing chromium. HANS KÄMMERER (to General Aniline Works). U. S. 1,727,468, Sept. 10. A fast yellow Cr-contg. dye is prepd. from the azo dye obtainable from diazotized metanilic acid and salicylic acid.

Mordant trisazo dyes. KARL HOLZACH (to General Aniline Works). U. S. 1,728,996, Sept. 24. See Ger. 477,061 (C. A. 23, 4081).

Vat dyes. BERTRAM MAYER and HUGO SIEBENBÜRGER (to Soc. anon. pour l'ind. chim. à Bâle). U. S. 1,728,068, Sept. 10. See Ger. 480,487 (C. A. 23, 5047).

Vat dyes. PAUL NAWIASKY and EMIL KRATZ (to General Aniline Works). U. S. 1,729,006, Sept. 24. Long-chain derivs. which are of good fastness provided they contain also a short-chain alkyl group may be produced by bringing the hydroxy derivs. of dibenzanthrones or iso-dibenzanthrones into reaction with arylsulfonic acid of ethylene glycol are particularly suitable, but those, for example, of propylene or butylene or other glycols or of glycerol or other multivalent alcs. or thioalcs. The derivs. employed. In addn. to their excellent fastness to light, the resulting dyes are very sol.

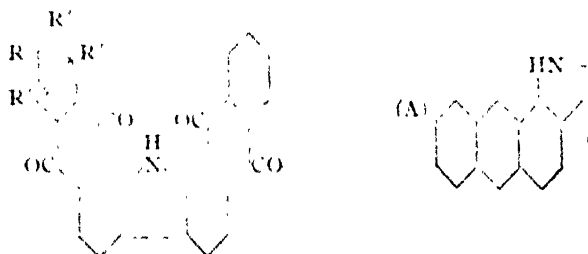
in org. solvents. This ready soly. renders the new dyes suitable for the production of colored lacquers. The new products obtained by the condensation of hydroxy derivs. of the ketones of the perylene series with toluenesulfonic acid esters of monoalkyl ethers of ethyleneglycol have been found particularly useful. Examples are given of products giving green shades.

Vat dyes. I. G. FARBENIND. A.-G. Brit. 307,328, Sept. 3, 1927. Vat dyes are formed by condensing halodibenzanthrones or haloisodibenzanthrones with amino-anthraquinones or their derivs.; with polyhalodibenzanthrone compds., the halogen atoms may be replaced wholly or partially by the aminoanthraquinone radical. Condensation may be effected in solvents or diluents such as PhNO_2 or naphthalene, with use of catalysts such as Cu or its salts or of acid-fixing agents, or both. The products dye gray, violet-black or black shades. Several examples are given.

Vat dyes. I. G. FARBENIND. A.-G. Brit. 307,364, Sept. 3, 1927. Vat dyes are obtained by condensing halogenated *ms* benzodanthrones, *ms*-naphthodianthrones, *allo-ms*-naphthodianthrones or *ms*-anthradianthrones (as described in Brit. 303,095 and in Brit. 303,184) with NH_3 or nitrogenous org. compds. contg. a reactive H atom attached to the N atom, such as aminoanthraquinones or their derivs., carbazole, isatin, or *p*-toluenesulfonamide (suitably in the presence of solvents or diluents of high b. p. such as PhNO_2 or naphthalene and in the presence of Cu or its compds. and acid-fixing agents. Numerous examples are given of the production of dyes of various colors.

Vat dyes. I. G. FARBENIND. A. G. Fr. 658,615, Aug. 6, 1928. Vat dyes in powder form are obtained by drying the dye paste with the addn. of a dispersing agent or a colloid protector, below 100° , preferably under vacuum.

Vat dyes. I. G. FARBENIND. A.-G. Fr. 659,519, Aug. 1928. Vat dyes of the anthracene series are prepd. by treating a dye having the probable formula:



where the 2 R' or the 2 R' positions are replaced by the group (A), the imino group occupying the position 8 or 5 in the central anthraquinone mol., by concd. H_2SO_4 with cooling, dilg. the reaction mixt. with H_2O and treating the ppt. with an oxidizing agent. An example is given using the dye obtained in example 2 of Ger. 240,080.

Blue vat dyes. KARL THIES, CARL J. MÜLLER and ERWIN HOFFA (to General Aniline Works) U. S. 1,728,987, Sept. 24. The 2,3-2,3'-bisnaphththionaphthen-1,10-diol giving gray-black tints with a green hue (produced according to Ger. 240,118, C. A. 6, 2177; the statements of the specification as to the dye dyeing greenish blue shades are incorrect) are transformed into vat dyes dyeing indigo-blue tints by halogenation. Thus, it is possible to prep. easily accessible vat dyes dyeing indigo-blue tints, but fast to Cl₂, kier-boiling and to light. The halogenation may be effected according to the known methods. Several examples are given.

Ester-like derivatives of vat dyes. MARCEL BADER, CHARLES SUNDER and THEODORE VOLTZ (to Durand & Huguenin S. A.) U. S. 1,727,267, Sept. 3. The process described in U. S. 1,448,251 (C. A. 17, 2195) is modified by use of salts of chlorosulfonic acid, e. g., the Na salt, instead of the acid itself. U. S. 1,727,268 relates to the similar use of SO_2 as such or of fuming sulfuric acid.

Anthraquinone dyes. I. G. FARBENIND. A.-G. Fr. 659,413, Aug. 22, 1928. Brown vat dyes are prepd. by the reaction of halogenated anthraquinones with 1-aminoanthraquinone 2 aldehyde at a high temp. Examples are given in which the bromoanthranthrones of Fr. 624,173 are used. Cf. C. A. 23, 3815.

Dyes containing chromium. HANS KRZIKALLA (to General Aniline Works). U. S. 1,728,998, Sept. 24. See Ger. 480,827 (C. A. 23, 5046).

Chromium dyes. I. G. FARBENIND. A.-G. Fr. 658,253, July 27, 1928. Dyes are chromated by treatment with Cr compds. with heat and under pressure, and the compds. obtained are treated with alk. agents as described in Ger. 419,825. Chromatable dyes are also converted to compds. sol. in water, by treatment with Cr or Cu compds. with

heat, and under pressure or not, in the presence of sol. salts of mineral acids, or if the Cr or Cu compd. is used in proportion less than that corresponding to 1 atom of Cr or Cu for a chromatable group, the sol. salts may be omitted.

Dyes and intermediates. I. G. FARBENIND. A.-G. Brit. 307,531, Dec. 7, 1927. Sulfonic acids of *N*-acetoacetyl arylamines are made by sulfonation of the acetoacetyl-aryl amines with exclusion, throughout the reaction, of water or agents contg. water. Sulfonated acetoacetanilide gives, by coupling with diazotized aniline, a yellow dye, and with diazotized sulfanilic acid, a reddish yellow dye.

Dye intermediates. I. G. FARBENIND. A.-G. Brit. 306,590, Nov. 23, 1927. *o*-Aminoarylmercaptans are formed by heating 2-aminoaryl-1-thiazolic compds. with NaOH soln. and the resulting mercaptans may be treated with chloroacetic acid to form the corresponding *o*-aminoarylthioglycolic acids. 2-Amino-4,5-benzo-6-methoxybenzo-thiazole (which may be used as a starting material in processes as just described) is made by treating 1-amino-4-methoxynaphthalene with an inorg. thiocyanate in the presence of a halogen.

Dye intermediates. I. G. FARBENIND. A.-G. Brit. 306,607, Nov. 18, 1927. An *o*-aminoarylthiocyano compd., in which the position *p*- to the amino group is occupied or forms part of a further ring (which may be prep'd. as described in Brit. 257,619; C. A. 21, 3057; or Brit. 303,813; C. A. 23, 4482), is treated with an alkali, preferably in the presence of a reducing agent, so as to saponify the thiocyno group and form a mercapto group which is coupled with chloroacetic acid and the resulting *o*-amino-arylthioglycolic acid finally diazotized and subjected to Sandmeyer's reaction to produce an *o*-cyanoarylthioglycolic acid. Several examples are given. Production of the Zn mercaptide of 1-methyl-2-amino-5-chlorobenzene-3-mercaptan is also described.

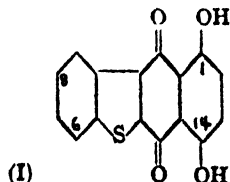
Dye intermediates. I. G. FARBENIND. A.-G. Brit. 307,130, Dec. 15, 1927. *o*-Aminodiaryl ethers such as *o*-aminodiphenyl ether, 5-chloro-2-aminodiphenyl ether, 5,2',5'-trichloro-2-aminodiphenyl ether and similar ethers are prep'd. by reducing the *o*-nitrodiaryl ethers obtained by reaction between an alkali metal salt of an aromatic hydroxy compd. and an *o*-dinitro compd. of the benzene series, with or without a diluent. Several examples are given.

Pyrazolones and dyes. IMPERIAL CHEMICAL INDUSTRIES, LTD. Fr. 659,744, Aug. 14, 1928. See Brit. 300,321 (C. A. 23, 4082).

Copper ammine complex azo compounds (dyes and insecticides). I. G. FARBENIND. A.-G. Brit. 306,859, Nov. 21, 1927. A diazo, diazoazo or tetrazo compd. contg. one or more carboxyl, hydroxyl or carbonyl groups in *o*-position to one or more azo or diazo groups is coupled with a coupling component in the presence of a water sol. complex nitrogenous Cu compd. Numerous examples are given and the prep'n of the following Cu compds. (which may be used in the process) is described: glycine Cu diammine, tetratrimethylamine Cu sulfate, tetra-(monomethylamine) Cu sulfate and Cu pyridine chloride.

Anthraquinone derivatives. SOC. ANON. POUR L'IND. CHIM. A BALB. Fr. 658,397, July 30, 1928. New derivs. of aminoanthraquinones are prep'd. by the reaction of aldehydes contg. more than one C atom, in the form of their bisulfite compds. or in the presence of bisulfites on aminoanthraquinone derivs. which contain at least one primary or secondary amino group. They may be used for printing cotton or silk or dyeing acetylcellulose. Examples are given.

Hydroxyquinones. I. G. FARBENIND. A.-G. Fr. 659,428, Aug. 23, 1928. Hydroxyquinones contg. S are prep'd. by submitting a thiophene-2,3-dicarboxylic acid or an anhydride thereof, simultaneously with a phenol in which 2 neighboring C atoms



are combined with H, to the action of an acid condensing agent at a high temp. In examples, 1,4-dihydroxybenzothioanthraquinone (I), m. 253-254°. 1,4-dihydroxy-6-methyl-8-chlorobenzothioanthraquinone, m. 291-292°, and trihydroxybenzothioanthraquinone, m. 241-242°. The compds. are intermediates for dyes.

Carboxylated *N*- ω -aminoalkylaminonaphthalenes. WINFRID HENTRICH (to General Aniline Works). U. S. 1,727,506, Sept. 10. See Ger. 468,811 (C. A. 23, 2723).

Salt-like compounds derived from dye bases of the triarylmethane series. OSWALD MEYER (to General Aniline Works). U. S. 1,729,003, Sept. 24. New salt-like compds. corresponding probably to the general formula: $(R \cdot NXX' \cdot OCO)_n C_{10}H_7-n(OH)$, in which formula R means the residue of a dye of the triarylmethane series, X and X' hydrogen or an alkyl group, n the no. 1 or 2, which compds. may be obtained by a double decompn. of a basic dye of the triarylmethane series with a hydroxynaphthoic acid compd. not contg. a sulfonic group or sulfonic salts. Dye salts of the triarylmethane series may be decomposed by means of alkali metal salts of hydroxynaphthoic acids, with aq. solns. of both components, whereby the new compds. sep. as insol. ppts. Also a carbinol base of the triarylmethane series may be caused to react with a hydroxynaphthoic acid in an alc. soln. The new salt-like compds. thus obtained are, when dry, colored powders of a metallic luster, almost insol. in water, easily sol. in alc. They may be used instead of the dye sol. in alc., which are known hitherto, their insoly. in water being of an especial advantage. They are therefore particularly suitable for the production of printing colors sol. in alc., which are insol. in water after printing. Compds. obtainable by reacting with a 2,3-hydroxynaphthoic acid compd. on a dye of the triarylmethane series, especially of the *p*-rosaniline type, are of a particular value. Several examples are given.

Lakes. I. G. FARBENIND. A.-G. Brit. 307,436, March 7, 1928. Lakes obtained by pptg. basic dyes, or acid dyes contg. amino groups, with the reduction products of complex phosphotungstosilicic acids obtained as described in Brit. 292,253 (C. A. 23, 1512) are boiled, which increases their fastness to light.

Dyeing. J. WAKEFIELD. Brit. 307,238, March 23, 1928. In dyeing with vat and S dyes and mineral khaki colors, all necessary operations are conducted in a closed open-width bleaching kier, with the material continuously in motion. Various details of procedure are described.

Dyeing. SOC. ANON. POUR L'IND. CHIM. A BAËLE. Fr. 658,364, July 23, 1928. Benzoin is caused to react with aromatic sulfonic or carboxylic acids such as the benzene- or naphthalene-sulfonic acids, benzoic or hydroxynaphthoic acids in the presence of condensing agents such as H_2SO_4 , oleum or CH_3SO_3H , and the products obtained are used as auxiliary agents in the prepn. of colors and in dyeing. The products obtained by sulfonating the residues from the rectification of BzH and turpentine are also used as auxiliary substances in the manuf. of colors.

Dyeing. I. G. FARBENIND. A.-G. Fr. 659,046, Aug. 16, 1928. In printing or dyeing with vat or sulfurized dyes, the dyes are used in the form of addn. compds. with other substances, *e. g.*, with metallic alcoholates, the products resulting from the action of alkalis on ketones, or with any other compds. capable of forming addn. compds. Examples are given.

Dyeing. I. G. FARBENIND. A.-G. Fr. 659,449, Aug. 24, 1928. In dyeing or printing with S or vat dyes the reduction is carried out with aliphatic, aromatic or hydroaromatic amines or heterocyclic bases concurrently with the hyposulfite or other reducing agents and preferably with the addn. of CH_2O if operating at a high temp.

Dyeing and printing. DURAND ET HUGUENIN SOC. ANON. Brit. 306,800, Nov. 28, 1927. Diethyl tartrate is used as the substance producing acid when heated, in processes such as are described in Brit. 281,336 (C. A. 22, 3536). An example is given for producing fast yellow on cotton.

Dyeing natural and artificial materials. I. G. FARBENIND. A.-G. Brit. 306,637, Dec. 6, 1927. Fast dyeings and printings are obtained on wool, silk and "acetate silk" by treatment with salts of non-sulfonated naphthalene derivs. contg. at least one 4-aminoarylamino group of the benzene series, with or without hydroxy or amino groups, followed by treatment with an oxidizing agent. Several examples with details are given.

Dyeing textiles. HENRY DREYFUS. Fr. 658,415, July 30, 1928. In dyeing textiles, particularly acetylcellulose with anthraquinone derivs. contg. free amino, alkyl-amino or arylamino groups, all harmful acid action on the fibers is suppressed by incorporating in the fibers one or more inorg. bases such as Na_2CO_3 , borax, $NaOAc$, Na palmitate or K oleate. Cf. C. A. 23, 3816.

Dyeing textiles, etc. E. SCHUELLER. Brit. 307,480, March 10, 1928. In dyeing textiles, skins, hairs, etc., by oxidizing phenolic or amino compds. such as *p*-phenylenediamine on the fiber by use of peroxides, catalysts are used which act like peroxidases, *e. g.*, metal salts such as salts of Fe, colloidal metals or metal compds. or vegetable substances such as ext. of potatoes, onions, cereals, radishes, cucumbers or mushrooms

or animal materials such as milk or blood or their derivs. The use of these catalysts improves the depth and purity of color obtained.

Dyeing fabrics in rope form. J. BUHLER. Brit. 307,296, March 3, 1928. An app. is described.

Dyeing piece goods containing esterified cellulose. I. G. FARBENIND. A.-G. Brit. 306,876, Oct. 25, 1927. In dyeing material contg. cellulose acetate or cotton which has been treated by the process described in Brit. 195,619 (C. A. 17, 3613) or Ger. 346,883 for the production of effects, staining of the esterified cellulose is prevented by adding to the dye bath a condensation product of a phenol or deriv. with H_2SO_4 and CH_2O or a sulfurized deriv. of a phenol or amorphous sulfonic acid or similar org. compd. which ppts. glue in acid soln. and dyes are used (various of which are enumerated) which have little or no affinity for the esterified cellulose.

Dyeing cellulose esters and ethers. BRITISH CELANESE, LTD., G. H. ELLIS and H. C. OLPIN. Brit. 306,981, Nov. 28, 1927. Unsulfonated thiazole derivs. are used (other than basic dyes such as Thioflavine T which is already described as used with cellulose ethers, in Brit. 196,953; C. A. 17, 3794). Several examples are given. Cf. C. A. 23, 4083.

Dyeing cellulose acetates. CHEMISCHE FABRIK VORM SANDOZ. Brit. 306,877, Oct. 27, 1927. Cellulose mono- and di acetate fibers, obtained by direct acetylation of cellulose without structural alteration, are dyed with materials "suitable for dyeing cellulose acetate silk" with the exception of basic dyes of the diphenylmethane, triphenylmethane, azine, thiazine and oxazine series. Numerous details and examples are given.

Dyeing viscose fabrics. I. G. FARBENIND A. G. Brit. 306,908, Feb. 27, 1928. Fabrics made of viscose of irregular phys. or chem. quality are dyed even shades by use of dyes contg. metals such as Cu, Ni or Co in complex combination. Numerous examples are given. Cf. C. A. 23, 5048.

Dyeing artificial silk. I. G. FARBENIND A. G. Fr. 658,658, Aug. 7, 1928. The affinity for dyeing of hydrated cellulose treated and solidified according to Fr. 636,863 (C. A. 23, 703) is increased by carrying out the treatment in the presence of salts, e. g., NaCl, or adding mordants to the treating bath.

Coloring fibrous cellulose derivatives. E. C. DE STUBNER. Brit. 307,516, Aug. 30, 1927. Nitrocellulose or other cellulose deriv. of fibrous cellular structure is colored by pptg. a pigment on the material. Cu may be pptd. from $CuSO_4$ with Fe or Zn. PbS may be pptd. from Pb acetate by H_2S . ZnO or lampblack may be deposited from a gaseous suspension.

Aniline-black and similar dyeing. I. G. FARBENIND A. G. Brit. 306,632, Dec. 5, 1927. Animal fibers are treated in an acid bath with sulfonated derivs. of the following types of amines for subsequent development of dyes of the aniline-black type by oxidation: 1,4-diaminobenzene substituted in one or both amino groups by a substituted or unsubstituted naphthyl residue; 1,1 di-4 aminophenylamino-benzene similarly substituted; or, diaminonaphthalenes substituted in one or both amino groups by a 4-amino (or 4-substituted-amino) phenyl group. Numerous examples and details are given.

Transfer pattern dyeing of fabrics. ELIAS KIRSCHENBAUM. U. S. 1,729,347, Sept. 24. Mech. features.

Low-pressure dye-vat construction. W. SADLER and J. B. SADLER. Brit. 307,621, March 2, 1928. The cover is formed of rotatable sectors which give access to all parts of the vat.

Apparatus for dyeing yarn with dye liquors of different colors simultaneously supplied to different parts of a yarn mass. LOUIS B. HASBROUCK (to Eclipse Textile Devices, Inc.). U. S. 1,726,981, Sept. 3. Various structural features are described.

Apparatus for dyeing garments, etc. SAMUEL SHAPIRO. U. S. 1,727,114, Sept. 10. The articles to be dyed are held in a foraminous basket which is vertically reciprocated in the dye liquor. Various structural details are described.

Apparatus for dyeing or other wet treatments of hanks, etc. ALFRED PE (to Oscar Kohorn & Co.). U. S. 1,728,878, Sept. 17. Structural features.

Apparatus for washing, dyeing or bleaching textiles. DEUTSCHE GOLD UND SILBER-SCHNEIDANSTALT VORM. ROESSLER. Fr. 658,328, June 29, 1928.

Apparatus for dyeing or washing cloth, etc. CECIL F. HAMMOND and WM. SHACKLETON. Fr. 658,703, Aug. 8, 1928.

Apparatus for bleaching, dyeing and washing fabrics in rope form. G. P. GASS and JACKSON & BRO., LTD. Brit. 307,632, March 16, 1928. Structural features.

Composition for softening and oiling textile fibers. SIGISMUND FUCHS (to I. G.

Farbenind. A.-G.). U. S. 1,728,118, Sept. 10. An emulsion suitable for treating wool or other textile materials comprises an oil such as olive oil together with water, an alkylated cellulose, and Na isopropynaphthalenesulfonate or other suitable alkali metal salt of an aromatic sulfonic acid contg. several hydrocarbon residues as side chains.

Protecting vegetable fibers. ORANIENBURGER CHEMISCHE FABRIK A.-G. Fr. 659,105, Aug. 17, 1928. Vegetable fibers are protected during the bleaching operation against the formation of oxycellulose by treatment before or during bleaching with oxidizable compds. such as C_6H_6 , $C_{10}H_8$, $C_{10}H_7 \cdot CH_3$, tetrahydronaphthalene, phenols, hydrophenols naphthols, hydronaphthols, ketones, terpene oils, etc., dissolved in colloidal form or as a very fine dispersion.

Apparatus for removing dressings from fabrics. CHARLES F. RYLEY (to Celanese Corp. of America). U. S. 1,727,041, Sept. 3. The fabric is wound on a perforated cylinder to the interior of which scouring liquid is supplied. Various structural details are described.

Singeing textile materials with a singeing flame formed by electric sparks. WALTER OSTHOFF. U. S. 1,726,678, Sept. 3. An app. is described.

Cleansing and other liquid treatments of textile materials. H. T. BÖHME A.-G. Brit. 307,397, March 6, 1928. The wetting power of treating liquors is increased by addn. to them of esters of adipic acid or of substituted adipic acids such as Et, Pr and Bu esters of methyl or ethyl adipic acid. These addns. may be used in the presence of soaps, sulfonated oils or naphthalenesulfonic acids which increase the soly. of the esters in aq. liquids.

Liquid treatments of textile materials. I. G. FARBENIND. A.-G. Brit. 306,913, Aug. 24, 1927. Materials composed wholly of natural animal or vegetable fibers are treated with dyeing, bleaching, mercerizing or other baths contg. alics. with over 2 C atoms in the mol. (which may be mixed with MeOH or EtOH), without use of soaps or other strong wetting agents or phenols. Several examples are given.

Bleaching fibers. CHEMISCHE FABRIK STOCKHAUSEN ET CIE. Brit. 307,251, May 24, 1928. Wetting and penetrating properties of oxidizing liquors used for bleaching natural or artificial fibers are increased by a preliminary or simultaneous treatment of the fibers with sulfuric acid compds. of oils, fats or fatty acids or their mixts. such as those obtained by processes as described in Brit. 293,480 (C. A. 23, 1766) or Brit. 293,717 (C. A. 23, 1766). These compds. also serve to protect the fiber.

Apparatus for bleaching fabrics in an open state. CHARLES TAYLOR. U. S. 1,720,021, Sept. 24. Structural features.

Apparatus for mercerizing textiles. TOOTAL BROADHURST LEE CO. Fr. 658,685, Aug. 8, 1928.

Mercerizing and other treatments of cellulosic materials. IMPERIAL CHEMICAL INDUSTRIES, LTD., and E. CHAPMAN. Brit. 307,239, April 14, 1928. Rapid and complete wetting of natural or artificial cellulosic materials in mercerizing or other treatments with alkali is effected by addn. to the alkali bath of about 1% of a mixt. of a homolog of phenol such as cresol or xylenol and an alc. contg. not less than 4 C atoms, such as benzyl alc., BuOH, AmOH or synthetic alics. b. 120–200° produced by hydrogenation of C oxides.

Treating yarns and fabrics with alkaline solutions of zinc. BRITISH CELANESE, LTD., and G. H. ELLIS. Brit. 306,611, Nov. 28, 1927. In processes such as are described in Brit. 302,775 (C. A. 23, 4353) solns. such as those of Na or K zincates are used instead of alk. solns. of Zn. Numerous details and examples are given.

Apparatus for impregnating lengths of fabric with viscose or other substances. A. H. KILNER. Brit. 306,586, Nov. 23, 1927. Structural features.

Treating threads; sulfonyl chlorides. I. G. FARBENIND. A.-G. Fr. 659,929, Sept. 3, 1928. Threads of cotton or other cellulosic fiber are made stronger with alkalies and then with haloides of sulfonic acids of aromatic bases, such as *dimethylaniline-p-sulfonyl chloride*, m. 110°, the corresponding *m*-compd. or the Et compds., or *m*-nitrobenzene sulfonyl chlorides, preferably in the presence of org. solvents.

Silk. DEUTSCHE GOLD UND SILBER SCHRIBANSTALT VORM. ROESSLER. Fr. 659,737, Aug. 9, 1928. Cocoons of silkworms are treated with HCN vapors to kill the worms rapidly and to impart a considerable resistance to the silk threads. The HCN is preferably mixed with CH_3O or the like.

Colloidal solutions of natural silk (for making artificial threads, etc.). T. MUTO, S. HIDA and KANEGAFUCHI BOSKII KANUSHIKI KWAISHA. Brit. 306,699, Feb. 18, 1928. Natural silk is treated with heated solns. of $Mg(NO_3)_2$ or other suitable Mg salts and the salt is sepd. (suitably by dialysis). The soln. may be concd. and threads

formed from it coagulated in a bath such as HOAc and MeOH. Gelatin, glucose or the like may be added. Thin sheets of the material can be formed on glass plates.

Apparatus for treating artificial silk in "cheeses." SONDERMANN & Co. Brit. 307,357, March 5, 1928. Various structural and mechanical details are described, relating to the treatment of the material with liquids.

Apparatus for treating skeins of artificial silk, etc., with washing or bleaching liquids, etc. J. L. RUSHTON, J. LEVER and H. HILL. Brit. 307,113, Dec. 7, 1927. Structural features.

Apparatus for washing, bleaching or other treatments of artificial silk, etc. JOHN LEVER and HAROLD HILL (to Dobson & Barlow, Ltd.). U. S. 1,728,767, Sept. 17. Structural features.

Waterproofing artificial silk. CUPRUM (SOC. ANON.). Fr. 658,747, Feb. 24, 1928. Artificial silk is waterproofed by treating it with a soap having a basis of Al_2O_3 dissolved in an org. solvent, the soap contg. a max. of 2 equivs. of fatty acid for 3 equivs. of Al .

Washing wool. E. C. DUHAMEL and COMPAGNIE GÉNÉRALE DES INDUSTRIES TEXTILES. Brit. 307,199, Feb. 20, 1928. Wool (suitably that rich in suint) is washed in a coned. suint liquor bath of the type which is periodically stopped for cleaning, and a quantity of fresh suint liquor of lower concn. and exceeding 1 l. per kg. of the entering wool is added intermittently. Simultaneously a quantity of coned. liquor in excess of 1 l. per kg. is removed from the bath so as to maintain the bath at about 3° Bé. Sepd. mud is discharged automatically.

Scouring wool, hair, fur, etc. V. G. WALSH and E. V. HAYES GRATZ. Brit. 306,916, Sept. 28, 1927. The material is scoured in the cold or at a temp. of 15-50° in alkali-free water contg. castor oil sulfonated with H_2SO_4 or a similar sulfonated vegetable oil. Wool on sheep may be thus scoured.

Oxidation of woollen cloth. ERNST GESSNER A.-G. Fr. 659,650, Aug. 29, 1928. An app. is described.

Mercerized cotton. CHEMISHE FABRIK VORM. SANDOZ. Fr. 659,118, Aug. 17, 1928. The luster of cotton, mercerized and etherified by aromatic acid chlorides as described in Fr. 563,735 and Ger. 346,883, is increased by steaming under pressure.

Rubberized cloth. THE ANODE RUBBER CO. (England), LTD. Fr. 658,811, Aug. 8, 1928. Cloth rubberized on one face is made by spreading a coned aq. dispersion of rubber mixed, if necessary, with other substances, on the cloth and solidifying it before it penetrates the cloth appreciably.

Shrinking and felting animal fibers. JOHN H. MARTIN. U. S. 1,727,374, Sept. 10. Fibers such as wool, hair or fur are treated with a liquor to which is added the condensation product of a bisulfite with an aldehyde, e. g., the product formed from CH_2O and a bisulfite which serves to prevent undesirable effects. U. S. 1,727,375 specifies use of a condensation product of SO_2 with an aldehyde such as CH_2O .

Felt. ALBERT CHARBONNEAU, MARC E. ASSADA and ESTHER PATTO. Fr. 659,483, Dec. 17, 1927. Felt is made from cellulose fibers, particularly viscose silk, by a mech. treatment to obtain the required length, then a chem. treatment by passing it through a Na_2CO_3 bath, then through a H_2SO_4 and HNO_3 bath and finally felting in known manner.

Treating felt and felt hat bodies. ERICH BÖHM. U. S. 1,729,474, Sept. 24. The luster of felt is increased by treatment with an aq. soln. of a complex compd. of a heavy metal of the Cr group such as a Cr tanning liquor. Several examples are given. Cf. C. A. 23, 2047.

Fabrics treated to imitate wash leather. H. W. TRELEAVEN, F. H. TRELEAVEN and W. JANVIER. Brit. 307,189, Feb. 10, 1928. Fabrics such as those prepd. as described in Brit. 289,592 (C. A. 23, 730) are softened by treatment in a cold bath of oil of *Pinus sibirica*, glycerol and water.

Continuously-operating apparatus for phosphating and washing fabrics. MARIUS RATIGNIER. U. S. 1,726, 858, Sept. 3. Structural features.

Detergents. L. R. HUBBARD (to British Celanese, Ltd.). Brit. 307,508, March 10, 1928. Comps. suitable for removing water sol. stains from artificial silk or other materials previous to treatment of the material with a usual dry cleaning liquid comprise soap, water and a substance such as cyclohexanol, cyclohexanone and their homologs, which is readily sol. in the dry cleaning liquid to be used and is also somewhat sol. in or miscible with water.

Wetting agents. H. TH. BÖHME A.-G. Fr. 659,072, Aug. 16, 1928. See Brit. 297,383 (C. A. 23, 2838).

26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

Present status of the technic of evaluating paint service. PERCY H. WALKER. *Am. Paint J.* 13, No. 49, 68ff(1929); *Paint, Oil & Chem. Rev.* 88, No. 13, 12ff(1929).—The visual changes taking place in a paint coating may be placed in 3 classes: (1) color, (2) physical changes in the surface, e. g., gloss, (3) deep-seated changes, e. g., cracking. Description and rating of such changes should be limited to the terms, slight, definite and bad. Panels should always be inspected under identical illumination, which can be accomplished by the use of artificial light. Sudden increase in the water permeability or the electrical cond. of a film are more reliable guides than visual appearance to the condition of the film.

G. G. SWARD

A paint man's views on the wood painting problem. CLARE H. HALL. *Paint, Oil & Chem. Rev.* 88, No. 12, 11(1929).—While the paint industry must develop coatings to meet unfavorable conditions it also must influence architects and builders to follow construction methods which reduce the no. of places through which water may enter.

G. G. SWARD

Wood painting problem as lumbermen see it. C. J. HOGUE. *Paint, Oil & Chem. Rev.* 88, No. 12, 11(1929).—Many troubles with paint on wood are due to conditions rather than materials. Some of the adverse conditions are fire-stopping, all-year-round construction and humidification of buildings, all of which are desirable. Other adverse conditions are hurried construction, false economy, poor ventilation of the building and poor drainage of the grounds which are undesirable. The remedy may be removal of the undesirable adverse conditions, improved formulation of paints and education of those concerned in the use of the proper paints.

G. G. SWARD

Aluminum paint as primer for wood. JUNIUS D. EDWARDS. *Paint, Oil & Chem. Rev.* 88, No. 13, 10-11(1929).—Although Al paints possess a very high impermeability to moisture, they do not blister in the manner of other paints. Such blisters as do form under unfavorable conditions are small. If the proper vehicle (bodied oil or spar varnish) has been used in the Al primer, lead or zinc paints applied over it will not check. Al paint is often very effective in sealing in creosote or the natural stains in wood. Al bronze powder does not accelerate the drying of oils.

G. G. SWARD

Regarding the behavior of paint coats on aluminum alloys. H. RÖHRIG. *Korrosion Metallschutz* 5, 85-8(1929).—Lautal sheets were painted with various paints contg. different metallic pigments and tested in salt H₂O sprays and by immersion in river H₂O. The salt spray pieces were subsequently subjected to tension and the deterioration in tensile strength upon exposure was measured. Pb paints caused deterioration because of deposition of Pb from salts produced by interaction of Pb soaps and NaCl. Al bronze paints tended to increase the resistance of the films and afford good protection to the metal.

B. F. ROETHLI

Note on the analysis of mixed paints. C. G. DAUBNEY AND B. A. ELLIS. *Chemistry & Industry* 47, 1147(1928).—The addn. of a small % of hydroquinone in the extn. of oil from paint by petroleum spirit completely prevents the formation of skin. Five mg. often suffices while 15-20 mg. may be needed for a 10-15 g. sample of paint. Because of the sparing soly. of hydroquinone in petroleum spirit, it is well to prep. a soln. of 0.5 g. per ml. in Et₂O. Four ml. of this soln. is stirred into the weighed sample and the petroleum spirit worked in. During subsequent extns. with petroleum spirit, the pigment settles rapidly.

W. H. BOYNTON

Oil absorption and viscosity of paints. HANS WOLFF. *Farben-Ztg.* 34, 2667-8 (1929).—To test the theory that the rates of change of viscosity of a paint are different before and after the point of brushing consistency is reached, W. has calcd. the "critical point" at which r in the vectorial equation, $r = \sqrt{x^2 + y^2}$, is a min. The relations between x and y are expressed in the equation, $k \left[100s \frac{100 - x}{100s + x(S - s)} \right]^n V - v = y$, where x , S , s , V and v represent % of pigment by wt., sp. gr. of pigment, sp. gr. of oil, viscosity of paint and viscosity of oil, resp., while k and n are consts. characteristic of the pigment. Values for n , k and the "crit. point" compared with the quantity of oil required for a paint of brushing consistency for 6 different pigments are given. While strict mathematical logic is not claimed, there is good agreement between "crit. points" and oil requirements.

G. G. SWARD

The additive quality of oil absorption. J. T. BALDWIN. *Ind. Eng. Chem.* 21, 320-9(1929).—Detns. of the oil absorption of pigment mixts. show that in general ab-

sorption is additive. The graph of oil absorption against pigment % in a mixt. of pigments is a straight line. Mixts. contg. active pigments such as red lead or ZnO are slight exceptions. Oil absorption is essentially dependent on the specific surface of the pigment and the interfacial tension or affinity between pigment and oil. A study of oil absorption curves of pigment mixts. in various vehicles should be helpful in estg. the relative activity of pigments, and of vehicles, the relative rate of diffusion of soap in vehicles and the relative cohesion between the particles of different pigments. The action of soap in paints may be largely interpreted by their ability to alter the adhesion tension. Soap concn. at the pigment-vehicle interface is one of the causes of livering. Stirring or the addn. of certain solvents reduces this concn. temporarily and the liver disappears.

W. H. BOYNTON

Color specification and prediction. A. C. WATSON. *Am. Paint & Varnish Manufs. Assoc. Sci. Section Circ. No. 341*, 978-89 (1928).—Specification is applied to define the color aspect of a pigment only, while prediction means the theoretical calcn. of what chromatic results will occur when 2 or more pigments of known chromatic character are mixed in any given proportion. The principles involved in such prediction are sketched with preliminary emphasis upon the necessity of including a statement of the transmission factors of any pigment, along with the reflection factors in any adequate statement of the pigment's true color character. Reflection coeffs. are measured by the use of a differential color rotator and a set of 7 approx. monochromatic color filters. The principles are summarized under 3 heads: (1) the principle of color specification, (2) the principle of pigment mixt. involving the effect of absorption upon reflection and (3) the principle of pigment mixt. involving the effect of transmission on the net reflection. Under (1) the reflection-transmission-absorption function is both quant. and qual. and no specification of a color material is adequate unless all these factors are all stated. In practical application of the principles discussed, the colorist requires: a set of mixt. graphs representing the typical results of mixing pigments of various reflection and transmission factors of any pigment. With these factors known reference to the typical mixt. graphs should effect great time saving.

W. H. B.

Studies of destructive light sources for use in accelerated weathering systems. F. C. SCHMUTZ AND D. L. GAMBLE. *Ind. Eng. Chem., Anal. Ed.* **1**, 83-6 (1929).—The relative darkening tendencies of a series of lithopones were detd. under: (1) the C arc, with impregnated carbons, (2) the Hg arc and (3) sunlight. A relationship is noted between the spectral characteristics of the light source used and the different degrees of darkening developed. A filter of ultra-violet transmitting glass around the Hg burner to eliminate the very short wave lengths gives promising results. The running characteristics are detailed of Hg arc lamps in which less highly fused quartz than normal is used. Measurements of the changes during service in the spectral distribution of the energy emitted indicate that a wattage control scheme is applicable for maintaining a const. total intensity. An automatic starting Hg burner of simple design is shown. The color tone of the darkening under one type of light was approx. the same, but it varied under the different tones and ranged from pure gray to a distinct yellow. The automatic lighting Hg arc is illustrated and several charts and tables are given.

W. H. BOYNTON

Results of accelerated fading test. J. J. WILLIAMS. *Am. Paint & Varnish Manufs. Assoc. Sci. Section Circ. No. 341*, 879 (1928). Panels of various yellow and green paints were exposed to ultra-violet light for 150 hrs. 16 in. (0.41 m.) from the light. Warm air at 34° is circulated continuously around the panels and a current of 170-180 v. is employed. Failure is a darkening which is probably due to reaction between pigment and vehicle. Very pronounced chalking resulted but no great difference is apparent between panels of the same group.

W. H. BOYNTON

A study of lithopone darkening. J. H. GOSHORN AND C. K. BLACK. *Ind. Eng. Chem.* **21**, 348-9 (1929).—Exptl. results on the darkening of lithopone pigments indicate that the reduction is due to the reduction to metallic Zn and probably free S. The whitening is due to oxidation of Zn to ZnO. The redarkening may be due in part to the decompn. of more ZnS. Quantities of metal used in driers (0.5% or less) are sufficient to cause sulfide darkening. The darkening with a metal present is probably due to both causes, the formation of metallic Zn and a dark-colored sulfide.

W. H. BOYNTON

The present state of the white lead question. K. WÜRTH. *Chem.-Tech. Rundschau* **44**, 953 (1929); cf. *C. A.* **23**, 2583.—The addn. of lithopone and zinc white to white lead results in lower toxicity but also lower durability on exposure to weather. Complete investigation of the comparative toxicities of lead sulfate and carbonate has not been made; the former may be less toxic but in finely powd. form all white lead pigments should be handled with care. White lead is not a satisfactory pigment for a priming

coat; its value lies not in its corrosion-preventative power but in its weather-resisting properties. The best rust-preventing pigment is red lead. Other lead pigments such as *Subox* (finely divided lead and lead oxide) and chrome yellow are mentioned.

E. PICKERING

White titanium oxide pigments. A. VILA. *Tech. moderne* 21, 434-9(1929).—The properties of these pigments are compared with other white pigments. P. T.

A study of whitening and linseed oil. R. G. BROWNING. *J. Oil & Colour Chem. Assoc.* 12, 211-19(1929).—Artificial whitening samples contg. increasing amts. of CaO were made into pastes with raw linseed oil. These pastes were then exposed to the air in the presence of (a) ultra-violet light, (b) daylight and (c) darkness; the color changes were detd. with a Lovibond tintometer. The amt. of free lime had little influence upon the discoloration which was slight and which also was practically the same in the dark as in the light. One hr. under the Hg arc was equiv. to about 2 days of winter sunlight. Putty prepd. from artificial whitening contg. Fe oxide yellowed normally but that contg. freshly pptd. Fe(OH)₃ discolored so rapidly that readings on the tintometer could not be taken.

G. G. SWARD

Research, its importance and its future. J. S. LONG. *Paint, Oil & Chem. Rev.* 88, No. 12, 12-14(1929).—An address of interest to the paint and varnish man and dealing in particular with the processing of linseed oil.

E. J. C.

Protective coatings. J. K. CROWELL AND E. F. SCHULDT. *Proc. Am. Gas Assoc.* 1928, 1458-61.—Procedures for testing protective coatings have been reviewed and the following procedure is suggested for coatings for underground piping. For detg. water-proofing ability, porosity and electrolysis, the inside of a metal dish (12" × 12" × 3") is painted and dried according to specifications and then filled with distd. H₂O contg. 20 g. NaCl per l.; into this is vertically suspended, within 1" of the bottom, a metal plate (2" × 4") which is connected to the dish through a milliammeter and the pos. pole of 2 dry cells. The ma. are recorded against time (days) as a record of the durability of the film. For the Harper test, strips of 28-gage black iron (3" × 6") are punched near one end for hanging, cleaned, dried and weighed. These are painted, weighed and allowed to dry to const. wt.; drying time should be noted. The resistance of the strip between 2 wet weighted disks (Harper Tester) is detd. by means of a Whitney ohmmeter; then one strip is placed in each of the following solns.: tap H₂O, distd. H₂O, 0.01% NaCl, 0.01% NaOH, 0.01% H₂SO₄. At the end of one week, the resistance is again measured and the procedure repeated until characteristic failures are noted. Bibliography.

A. S. CARTER

Non-volatile content. H. L. HAZELTINE. *Instruments* 2, 269-71(1929).—Details of method and app. for detg. non-volatile content of paints and varnishes by distn. are given.

C. Z. ROSECRANS

Studies in the drying oils. X. Fumes from oil kettles. D. S. CHAMBERLIN, E. R. THIES, P. F. SCHLINGMAN AND J. S. LONG. *Ind. Eng. Chem.* 21, 333-8(1929).—Part of the fumes arising from the cooking process are the result of the destructive distn. of the oil. This causes cracking at the double bonds. The fumes from linseed oil consist largely of fine droplets of decompn. products such as org. acids and aldehydes which may be absorbed and retained by causing the fumes to impinge on surfaces wet with drying oils contg. free org. acids, aldehydes or other decompn. products of the oil. Addn. of a small % of metallic driers during heat-bodding decreases the gross loss greatly and changes the course of the chem. reactions. A modified du Noüy tensimeter for use with oils and varnishes is described. Min. figures for the critical temp. of some drying oils were detd. by direct observation. Results are discussed.

W. H. BOYNTON

Effect of age on the apparent gain in weight of drying-oil films. P. E. MARLING. *Ind. Eng. Chem.* 21, 346-7(1929). The absorption of O₂ is accompanied by a chem. change which decomposes the oil film and causes volatile products to be given off. Tests are given comparing some of the phys. properties of several drying oils and their apparent gain in wt. during aging. Results are expressed as the apparent gain % in wt. of the original oil films. Curves show comparisons of raw, boiled and oxidized linseed oil and of china wood, linseed, perilla, soy bean and fish oils.

W. H. BOYNTON

The variables in bodding linseed oil. J. S. LONG. *Am. Paint J.* 13, No. 48, 20 ff; *Paint, Oil & Chem. Rev.* 88, No. 12, 12 ff(1929).—The processing of linseed oil may be considered to be the initial stage in the drying of films and as such should be strictly controlled. Some of the principal factors entering into this control are temp., rate of heat transfer, handling, humidity, driers, type of oil, etc.

G. G. SWARD

Film characteristics of the ester of the component fatty acids of linseed oil. B. H. THURMAN AND W. R. CRANDALL. *Ind. Eng. Chem.* 20, 1390-2(1928).—A series of tests on esters of fatty acids of linseed oil indicates that: the elimination of the poly-double-

bonded components is desirable and the poly-double-bonded acid components of drying oils are responsible for after-yellowing when present in a simple and unpolymerized condition in a film. Reduction of the plural ethylene linkages to a stage approximating the oleate stage is advantageous where permanency of texture and color of a film is desired. The esters of the less unsatd. fatty acids like oleic acid are very stable in films. The esters of the more unsatd. acids when present in the unpolymerized form are not so stable as shown by their tendency to become sticky, odorous and dark-colored. It is advantageous to compose films of lower I no. fatty constituents which may be effected by use of oleic derivs. or substances or similar I no. range obtained by polymerization of linseed oil or certain mixts. of oleic and stearic derivs., obtained by hydrogenation of linseed oil. The yellowing of drying-oil films arises from oxidation of the highly unsatd. fatty acid groups; it and drying of linseed films are not interdependent. It is also independent of the presence of glycerol and is a necessary consequence of such oxidation.

W. H. BOYNTON

Some observations on the cooking of China wood oil. R. I. HOUCK. *Paint, Oil & Chem. Rev.* 86, No. 21, 10(1928).—China wood oil is better regarded as a polymerizing than as a drying oil. Polymerization is a factor of time and temp. In a China wood oil varnish the combination with gum is, in part at least, chem. It appears to be the case that the monobasic eleostearic acid radicals become linked at the double bonds to form polybasic acids which with the polyhydric alc., glycerol, form polymers of which the so-called glyptal resins are only another example. Possibly the acid resins react at high temps. to form mixed esters so that the varnish film might be regarded as a synthetic resin. The course of polymerization of China wood oil when cooked with amberol is indicated by the livering of overbodied amberol wood oil varnishes with basic pigments. Although amberol is less easily saponified than ester gum or rosin and does not liver in linseed oil, the China wood oil-amberol is apparently in a condition of polymerization which is stable except in the presence of basic pigments, which catalyze the further polymerization.

W. H. BOYNTON

The mechanism in the formation of wrinkles in wood oil films. A. V. BLOM. *Chem. Umschau Fette, Oele, Wachse Harze* 36, 229-36(1929).—The formation of wrinkles may occur simultaneously with that of crystals of β -eleostearin, either formation may occur separately, and crystals may appear before or after wrinkling; no definite law could be formulated to correlate these variations. The change of α -eleostearin to the cryst. β -form seems to be bound up with light rays of long wave length. The growth of mols. into larger complexes by condensation or polymerization, etc., causes formation of "germ" nuclei which are less sol., offer less active surface and have a tendency to travel toward the surface where their increasing no. finally push the solvent away and form a continuous layer, the individual mols. of which are standing upright with the surface potential at a min. Solid monomol. films possess no surface tension, verified by tests with wood oil films under the microscope. A de-salvation implies a vol. increase, resulting in wrinkles. The film during aging is subject to internal stresses which show themselves by double refraction with crossed nicols.

P. ESCHER

Oil of amber. P. MAX GREMPPE. *Teer u. Bitumen* 27, 431(1929).—The dark brown residual oil from the purification of low-grade amber is of disagreeable odor and limited drying ability. It has some use as a solvent and as a constituent of shoe polish.

W. H. STAERNER

The drying of tung oil varnishes. F. WILBORN. *Farben-Ztg.* 34, 2775-6(1929).—Tung oil varnish was caused to dry with a clear film on the one hand and with a mat film on the other. When the films were dry the increases in weight were 8 and 2%, resp. Drying of tung oil films takes place not uniformly but in patches which grow and unite as drying proceeds.

G. G. SWARD

The reactions taking place in the manufacture of oleo-varnishes. JOHANNES SCHEIBER. *Farbe u. Lack* 1929, 393-4, 404-5, 418-9.—S. briefly reviews previous work on the displacement of the fatty acids of glycerides by resin acids during cooking of varnishes. The acid value of the resin is no criterion of its ability to displace fatty acids. The resins may be placed in 2 main groups according to whether they do or do not displace the fatty acids. Typical of the first group are resin, Congo and Manila copals; of the second are kauri and amber. Blooming is ascribed to efflorescence of fatty acids, while pitting may be due to volatilization of the acids under certain circumstances.

G. G. SWARD

Simple accelerated exposure test for varnishes and lacquers. HUGO V. HANSEN. *Ind. Eng. Chem.* 20, 1384-5(1928).—A simple app. and its operation are outlined. Test panels 2.5×13 cm. are exposed in a shallow pan under ultra-violet light. By means of an intermittent siphoning app. the panels are periodically covered with water and allowed

to dry out. This subjection to wet and dry cycles in conjunction with light hastens failures in a manner correlated with the behavior on weathering. The app. must be calibrated against standard material and considerable experience is necessary for interpretation of results. Once this experience is gained the test should be useful as a rapid approx. control for new materials.

Nitrocellulose as a factor in the lacquer industry. LOUIS A. HELWICH. *Chem. Obzor* 4, 245-7 (247-8 English) (1929).

Suggestions on manufacture of black lacquer enamel. PAUL M. MOWEN. *Paint, Oil, and Chem. Rev.* 86, No. 23, 10(1928).—Suggestions cover: the correct selection of solvents, pigments, gums and pyroxylin in mfg. a jet black rubbing lacquer.

Distillation of resinous products in the Landes forest. R. VRINAT. *Arts & métiers* No. 107, 308-11(Aug., 1929).—A brief description of the Ropars and Courret processes of distn. of gum turpentine, which are the ones chiefly used in the plants in the Landes region.

Analysis and examination of formo-phenolic resins. A. B. LORGES. *Rev. chim. ind.* 38, 130 2, 198-202(1929).—A review of the current methods in use.

"Supraresen," a new resinous product. JOHANNES SCHEIBER. *Farbe u Lack* 1929, 428 9.—"Supraresen" is the term applied to residue obtained when dammar is prepd. for use in lacquers. It is sol. in the aromatic hydrocarbons and may be incorporated into varnishes. The m. p., acid no. and sapon. no. range from 85° to 130°, 12.3° to 21.3° and 35.9° to 91.7°, resp.

Scratch hardness determination with lead pencils. HANS WOLFF and FELIX WILBORN. *Farben-Ztg.* 34, 2721-2(1929).—To increase the precision of the Wilkinson pencil hardness detn., the following procedure is recommended. The panel is placed on one pan of a balance and a 300 g. load on the other. With the pencil held at an angle of 40° with the horizontal, a wavy or an l-shaped line is made. Pencils of increasing hardness are used until a scratch results. Pressure sufficient to tip the balance is exerted. For films harder than a 7H pencil it is advantageous to hold the panel in the hand.

G. G. SWARD

Pioneer work in development of white lead manufacture by Sperry electrolytic process (BOWMAN) 4. Lead [pigments] (SANTMYERS) 18. Chemical and physico-chemical investigation of the chief brands of Paris greens (DESHUSSES, DESHUSSES) 15. Chemical analysis of the oleoresins as a means of distinguishing Jeffrey pine and western yellow pine (MIROV) 11D. The vapor pressure of tetralin (PIATTI) 2. The constitution of bakelite (BLUMFELDT) 10. Removing resins from fibrous and other materials (Brit. pat. 307,360) 13. Bag-filter apparatus for varnish, etc. (U. S. pat. 1,726,758) 22. Roller mill for grinding paints (Brit. pats. 307,312-13) 1.

Incorporating paint ingredients. KRAUSEWERK A.-G. Brit. 306,926, Feb. 29, 1928. In a modification of the process described in Brit. 305,452 (C. A. 23, 4836), residual water is expelled from a washed pigment by use of a liquid such as alc., the paste of liquid and pigment is mixed with a varnish or oil immiscible with the liquid and the mixt. is subjected to treatment such as churning to expel the liquid and coalesce the other ingredients.

White pigment base. ALBERT E. MARSHALL (to Maryland Pigments Corp.). U. S. 1,728,206, Sept. 17. Ilmenite sand contg. silica is treated with phosgene gas to remove Fe, the remaining silica and TiO₂ are fused with an alkali such as Na₂CO₃ and the oxides are pptd. to obtain a pure white pigment base.

Iron oxide pigments. EARL H. MCLEOD (to Ault & Wiborg Co., of N. Y.). U. S. 1,726,851, Sept. 3. A mixt. comprising a ferrous salt such as FeSO₄, pptd. Fe(OH)₃, and sufficient precipitant such as Na₂CO₃ to ppt. all the Fe is permitted to react, and the product is heated with an oxidizing agent such as CaOCl₂. U. S. 1,726,852 specifies making ferro-ferric oxide by dissolving a ferric oxide in a strong inorg. acid such as HCl and effecting pptn. of the Fe ions of the resulting salt as Fe(OH)₃ in intimate combination with pptd. Fe(OH)₃ by adding Na₂CO₃ and a ferrous salt such as FeSO₄. The product may be varied in compn. and color.

Asphalt emulsions suitable for use as paints and water proofing compositions. A. L. HALVORSEN and P. M. TRAVIS (to Emulsion Process Corp.). Brit. 307,288, March 3, 1928. Molten asphalt (preferably of low mineral content and of m. p. not substantially exceeding 100°) is added, slowly and with stirring, to hot water contg. not more than 0.75% (preferably less than 0.3% of the total emulsion) of a tribasic alkali phosphate such as Na₃PO₄, and the resulting emulsion is homogenized (suitably in

a colloid mill) and is cooled with gentle agitation. The emulsions may contain up to 75% of asphalt. Cf. *C. A.* 23, 3571.

Lithopone. *SOC. INDUSTRIELLE DE PRODUITS BARYTIQUES.* Fr. 659,210, Aug. 21, 1928. Stabilization of lithopone to light and bluing is obtained by introducing into the mass of lithopone at any stage of its manuf. a small quantity of one of the insol. compds. of Co known under the name of cobalt blue.

Mill, with grinding plates, for grinding paints, inks, enamels, etc. *C. J. COOPER and A. M. MASON* (trading as C. J. Cooper & Co.). Brit. 306,630, Dec. 3, 1927. Structural features.

Printing ink. *A. R. TRIST.* Brit. 307,535, Dec. 9, 1927. Ink for printing from printing plates having mercurized non-printing areas consists of partially polymerized linseed oil contg. about 7.5% fatty acids, pigments and Hg. Examples are given.

Drying oils. *STANDARD OIL DEVELOPMENT CO.* Fr. 659,823, Aug. 31, 1928. The Co salt of a sulfonic acid obtained as a by-product in the treatment of petroleum oils with SO_3 or fuming H_2SO_4 is used as a drier in drying oils. Fr. 659,824 describes the use of the corresponding Mn salt. Fr. 659,825 describes the use of the corresponding Pb salt.

Varnishes. *BAKELITE GES.* Fr. 658,718, Aug. 8, 1928. Lacquers or varnishes are made by mixing artificial resins, softened by heat but not fusible, in appropriate solvents such as hydrated phenols, cyclic ketones or their homologs, furfural or hexalin.

Varnishes. *I. G. FARBENIND. A.-G.* Fr. 658,243, July 28, 1928. Varnishes consisting of solns. of natural or artificial resins in alc. are made colorable or colored opaquely by adding to the varnish, during or after coloration with basic dyes, small quantities of strong org. or inorg. acids, salts having an acid reaction or nitrates sol. in the alc. Cf. *C. A.* 23, 3821.

Varnishes. *I. G. FARBENIND. A.-G.* Fr. 659,640, Aug. 29, 1928. Surfaces to which cellulose varnishes are to be applied have applied thereto an intermediate layer composed of a soln. of an albuminous substance such as casein to which are added resins and appropriate softening agents. A hardening agent is incorporated in the soln. or applied to the layer.

Varnishing surfaces. *I. G. FARBENIND. A.-G.* Fr. 659,163, Aug. 20, 1928. Surfaces to be varnished with cellulosic varnishes are first coated with a soln. of cellulosic esters of higher fatty acids with the addn., if desired, of resin, rubber, dyes, filling materials, etc.

Nitrocellulose lacquers, etc. *W. J. JENKINS and IMPERIAL CHEMICAL INDUSTRIES, Ltd.* Brit. 307,528, Nov. 10, 1927. Compns. are formed which include various ingredients among which are compds. such as β -methoxyethyl propionate, β -hydroxy-methyl propionate, dammar, ester gum, Bu propionate, linseed oil, tricresyl phosphate, EtOH and turpentine, together with nitrocellulose, pigments, etc.

Cellulose ether lacquers. *I. G. FARBENIND. A.-G.* Brit. 307,361, March 5, 1928. Cellulose ether lacquers are made contg. oxyms such as linoxyn, with or without various other ingredients such as plastifying or gelatinizing agents, resins, nitrocellulose, coloring materials, etc., and with appropriate solvents, examples of which are given.

Cellulose acetate compositions. *R. L. KRAMER* (to E. I. Du Pont de Nemours & Co.). Brit. 306,911, Feb. 27, 1928. In making lacquers, enamels, plastics, films, coated fabrics, etc., a softening agent is used consisting of a carboxylic acid ester of an aryloxy ethanol such as phenoxyethyl phthalate, methylphenoxyethyl phthalate and laurate and esters derived from β -methylnaphthoxyethanol. Manuf. of some of these esters is described.

Coating compositions containing cellulose derivatives and synthetic resins, etc. *W. H. Moss and B. B. WHITE* (to British Celanese, Ltd.). Brit. 307,290, March 3, 1928. Synthetic resins produced from aniline and furfural are added to compns. such as lacquers contg. cellulose esters or ethers, and various other ingredients such as solvents, plastifiers, pigments and dyes and natural or other synthetic resins. Synthetic resins from other aromatic amines such as toluidine, xylidine, naphthylamine or from substituted amine such as nitroaniline also may be used and many optional ingredients are listed. Brit. 307,289 (*W. H. Moss* to British Celanese, Ltd.) specifies generally similar compns. contg. synthetic resins produced from acetone and furfural. Brit. 307,291 (*W. H. Moss* and *B. B. WHITE* to British Celanese, Ltd.) specifies the use of synthetic resins from phenol and furfural in generally similar mixed compns. Brit. 307,292 (*W. H. Moss* to British Celanese, Ltd.) describes lacquers, etc., formed with a cellulose ester or ether, a natural or "semi-synthetic" resin and plastifiers, solvents, pigments, dyes, etc. Cf. *C. A.* 23, 4582.

Coating compositions containing glycerol-phthalic anhydride resin. *BARRISH*

THOMSON-HOUSTON CO., LTD., H. W. H. WARREN and R. NEWBOUND. Brit. 306,914, Aug. 31, 1927. The resin is dissolved in a mixt. of solvents of graded b. p. such as acetone, denatured alc., C_6H_6 and Et lactate, with or without coloring substances. The coating may be baked first at 100° and then at 200° .

Artificial resins. BAKELITE, LTD. Fr. 658,411, July 30, 1928. In prepg. resinous condensation products from a urea, or a urea and a phenol, and an aldehyde, the initial sol. and fusible product is subjected to distn. under vacuum and then to open boiling, the products being rendered insol. and infusible by further heating. The distn. may be carried out in the presence of a dehydrating agent such as BuOH. An alk. condensing agent such as $(CH_2)_6N_4$ may be added toward or at the end of the mixing and an acid condensing agent such as oxalic acid at a later stage. Other details of working and examples are given. Cf. C. A. 23, 3821.

Synthetic resins. CANADIAN ELECTRO PRODUCTS CO. Fr. 658,684, Aug. 8, 1928. Vinyl halides, as well as vinyl esters, react with a satd. aliphatic aldehyde in the manner of Fr. 643,419 (C. A. 23, 1517). The reaction takes place in a shorter time if the proportion of aldehyde is increased.

Synthetic resins. SCOVILL MANUFACTURING CO. Fr. 659,327, June 28, 1928. See Brit. 292,912 (C. A. 23, 1517).

Synthetic resins. GRINDLEY & CO., LTD., and R. L. YEATES. Brit. 306,924, Nov. 30, 1927. Resinous products are prepd. by bringing together a polyhydric alc. such as glycerol, a polybasic acid or its anhydride such as phthalic anhydride, and an acid resin such as "French rosin" or a fatty acid such as oleic or stearic acid derived from a non-drying oil or a fat, and there may also be added fatty acids derived from drying oils such as linseed or china wood oil, or oxides, hydroxides or suitable salts of Al, Ca or Zn, plasticizers, etc.

Synthetic resins. P. HALLER and H. KAPPELER. Brit. 306,972, Feb. 29, 1928. In processes such as those described in Brit. 266,358 (C. A. 22, 691) and Brit. 274,501 (C. A. 22, 2282) in which CH_2O is condensed with arylamines in an acid medium to form a gel and the action is then stopped by adding a base or basic salt, this after-treatment is shortened or eliminated by adding to the reaction mixt., initially or before the formation of the gel, a salt sol. in water or alc. such as NaCl, NH_4Cl , $CaCl_2$, NH_4NO_3 , Na_2SO_4 , $MgSO_4$, or Na lactate.

"Mosaic" linoleum fabric simulating tile, etc. EDWARD C. DEARDEN (to Geo. W. Blabon Co.). U. S. 1,728,397 8, Sept. 17. Different linoleum compns. are used and various details of manuf. are described.

Moldable composition containing phenolic resin. VICTOR H. TURKINGTON (to Bakelite Corp.). U. S. 1,728,378, Sept. 17. A potentially reactive phenolic resin compn. with a CH_2 -contg. hardening agent such as $(CH_2)_6N_4$ is used with a filling material, e. g., wood flour, and with benzaldehyde or furfural or other reactive aldehyde with a b. p. substantially above 100° .

27—FATS, FATTY OILS, WAXES AND SOAPS

E. SCHERUBEL

Supplement to the Report of the March Session of the German Fat Analysis Commission. ANON. Chem. Umschau Fette, Oele, Wachse Harze 36, 203-8, 218-20 (1929).—Methods are given for the examn. of edible fats, waxes and wax products.

P. ESCHER

Solid fats. (Preliminary communication.) A. VAN RAALTE. Rec. trav. chim. 48, 1058-60 (1929). Fats having the same fatty acids may differ in the constitution of the glycerides. With a mixt. of alc. and acetone a solid fat can be divided in a liquid and a solid part. The n, I no. and Crisner no. (demixing temp. of fat and aniline) can be detd. on the 2 parts and thus the fats be identified as to their origin. E. S.

The recovery of fats from fuller's earth. H. POMERANZ. Seifensieder-Ztg. 56, 212-3 (1929).—Fats of a light color are obtainable from spent fuller's earth by benzine extn. if the extn. is not carried too far, because the last fractions ext. the main body of the coloring matter of oxidized fats. Extn. of fats by means of NaOH soln. is impractical on account of the large vol. of resulting soap soln.

P. ESCHER

Composition of wool fat. J. C. DRUMMOND and L. C. BAKER. J. Soc. Chem. Ind. 48, 232-8T (1929).—Wool fat extd. with petr. ether from crude merino wool contained small quantities of free fatty acids or alcs. and no glycerol. It consisted largely of the fatty acid esters of the higher aliphatic alcs. of cholesterol and the alc. known as iso-

cholesterol. Negligible traces of fatty substances contg. N and P were present. The fatty acids consisted of the satd. acids, cerotic, palmitic and stearic; myristic acid was detected. No evidence was obtained of lanopalmitic acid and lanocerac acid and its lactone, $C_{40}H_{80}O_2$, as described by Darmstädter and Lifschütz. The unsaponifiable matter consisted of cholesterol, isocholesterol and cetyl and ceryl alcs. Isocholesterol m. 139–40° and has an optical rotation of +84°. The degree of unsatn. has not been detd. and it is not readily reduced by H and Pd at room temp. Its analysis indicated a smaller C content than would be required for an isomeride of cholesterol, $C_{27}H_{46}O$. No detectable amts of ergosterol were found. E. SCHERUBEL

Bleaching bone grease and offal fats with 30% hydrogen peroxide. O. UHL. *Seifensieder-Ztg.* 56, 211–2(1929).—These fats require an acid wash with dil. H_2SO_4 at 70–80°, and can then be successfully bleached with 30% H_2O_2 ; 1–2% is used at 35° with const. stirring. P. ESCHER

Detection of annatto in fats. P. GUARNIERI. *Ind. olii min. e grassi* 9, 73–4 (1929).—Ext. with 5 cc. of H_2O a mixt. of 50 g. of oil or melted filtered fat with 50 cc. of a mixt. of equal parts of EtOH, ether and petr. ether, in the presence of a little $NaHCO_3$. Filter the H_2O -alc. soln. of the color. If the filtrate has no color, annatto is excluded. If it is yellow, maize oil, palm oil and soy oil pigments, or other natural or artificial colors sol. in alk. H_2O may be present besides annatto. With more than traces of annatto the filter becomes slowly pinkish orange, stronger after washing with ether. To detect traces of annatto filter the H_2O -alc. soln. into a small crucible and dip one end of a slip of blotting paper into the soln. The soln. is slowly absorbed, and the immersed part and near zone of the paper become pink. The reaction takes some hours; it is characteristic for annatto, distinguishing from the yellow natural pigments of fats. The washed slip gives a deeper pink with a drop of HCl and with HNO_3 turns bluish green. Alkalies have no action. The color fixed on the paper is not fast to light. R. SANSONE

Manufacturing cod-liver oil at sea. ARTHUR D. HOLMES. *Feedstuffs* 1, No. 10, 12(1929).—A brief description of the manuf. of cod-liver oil on board fishing vessels. K. D. JACOB

Refining linseed oil for edible purposes. R. DIETERLE. *Seifensieder-Ztg.* 56, 213–4(1929); cf. *C. A.* 23, 1519.—Only light-colored oils (from the Anderson expeller) can be used; they are bleached with 3–6% of high-grade fuller's earth at 95°, then refined with NaOH at 100°, treated with 0.1% blankit, washed thoroughly and filtered with 1/4% earth through "Zeitz's" asbestos filter. P. ESCHER

A unique adulteration of palm oil. M. AUERBACH. *Chem. Umschau Fette, Oele, Wachse u. Harze* 36, 268(1929).—By stirring wood ashes from fires under the kettle into crude palm oil, the natives at Lagos reduce the free fatty acids by 1–2%. P. E.

Influence of heat on the color of soy-bean oil and changes at 180–225° under influence of nickel on a support. H. I. WATERMAN and M. J. VAN TUSSEN BROEK. *Chem. Weekblad* 26, 410–3(1929).—Investigations have been made on the influence of heat at different temps., both in the air and in a vacuum, on the color, viscosity and I value of soy-bean oil. The color and viscosity increased, whereas the I value remained practically const. At 145–55° the oil heated in vacuum is darker than that heated the same way at 195–205°. Oil can be heated at 100° in the air without any change. In connection with the hardening process, it has also been ascertained whether the presence of active Ni in infusorial earth, when heated, intensified the differences in question. By heating at a temp. of 180–185° and also at about 225° for 5 hrs., a considerable change took place. The viscosity and refraction greatly increased and the I value showed considerable decrease, whereas the thiocyanogen I value showed hardly any fluctuation. The alterations must have taken place under influence of the Ni. The catalytic activation is attended by the same kind of selectivity as occurs in the catalytic oil hardening process in the presence of H. E. SCHOTTE

Determining impurities in green olive oils. G. BIANCHINI. *Ind. olii min. e grassi* 9, 93(1929).—Impurities are detd. as insol. matter in cold CS_2 . Oils kept at 100° for many hrs. yield a lower % of impurities than the untreated. Oils contg. more than 10% of H_2O are mixed with the CS_2 , brought onto a filter and left in a stove at 40–50° until this is dry. The % of impurities is calcd. on the dry oil. To det. impurities in the oils for refining, use petr. ether b. below 70° instead of CS_2 . Et_2O is used for detg. impurities in oils for unwashed soaps; otherwise, a sep. detn. is conducted with petr. ether. R. SANSONE

Determining moisture in green olive oils. G. BIANCHINI. *Ind. olii min. e grassi* 9, 93(1929).—Green olive oil is dried better for this detn. in water ovens heated to 100°.

In hot-air ovens if the temp. at the top is 105° it may be 120° and more in the lower portion where the capsule with the oil is placed, producing discordant results with strongly acid oils. Com. oils contain generally 5% of moisture. R. SANSONE

Free acid in green olive oils. G. BIANCHINI. *Ind. olii min. e grassi* 9, 93(1929).—By detg. in the warm with 95% alc. and phenolphthalein, and titrating with $N/3$ or $N/10Na_2CO_3$, sensible differences are not obtained in comparison with the method using a mixt. of alc. and ether. Warm 95% alc. gives the best results. The % of acidity is calcd. on the dry oil free from impurities. R. SANSONE

Controlling the strength of sulfonated oils. A. VIANELLO. *Giorn. chim.* 1928; *Boll. assoc. ital. chim. tessili e color* 5, 72-5(1929).—Herbig's method is exact for detg. total fat. For total H_2SO_4 decompose 10 g. of oil with HCl, boil 1 hr., pass across thick wet filter, neutralize the residue with warm H_2O , bring the filtrate to a fixed vol. and ppt. a part with boiling $BaCl_2$, collect the ppt., wash, calcine and weigh, calcg. H_2SO_4 on 100 g. of oil. For detg. H_2SO_4 as Na or NH_4 salt dissolve 10 g. of oil in Et ether, wash with satd. NaCl, pass across a thick wet filter, bring the filtrate to a fixed vol. det. in a part H_2SO_4 as $BaSO_4$. For the H_2SO_4 in org. combination deduct from the total H_2SO_4 that combined as alk. sulfates. 98 parts H_2SO_4 = 378 sulforicnoleic acid. For detg. neutral fat ext. 30 g. of oil in 50-cc. H_2O , 20-cc. ammonia and 30-cc. glycerol, with two lots of 100 cc. Et ether; unite the exts.; wash with H_2O and evap. the solvent; dry the residue at 100-105° and weigh. For the nature of the oil sulfonated observe the aspect, odor, alc. soly., rotary power, I no., acetyl no. Find fish oils with the Halphen, Tortelli and Jaffe reactions. Sulfonated fish oils contain fat insol. in petr. ether. The sulfonates are dried in CO_2 for exact results. The H_2O % is detd. by Marcusson's method. For unsaponifiable matter treat 10-20 g. of oil in alc. KOH, evap. the alc., dissolve the residue in hot H_2O , acidify with HCl and agitate with petr. ether, let stand 24 hrs., sep. the ether contg. non-oxidized, unsaponifiable matter, wash twice with H_2O , filter, mix with cold alc. KOH for sapon. non-oxidized fatty acids, sep. the ether and distil from a tared flask, drying the residue at 95°. More than 2-3% unsaponifiable matter indicates adulteration with mineral oil, resin oil, wool fat, etc. The aspect, odor and refractive index show the nature of unsaponifiable matter. R. SANSONE

The Wecker patent. C. R. *Seifensieder-Ztg.* 56, 244(1929).—Some reasons are given which make the validity of the Wecker patent doubtful. R. OCKEL. *Ibid* 252.—Polemical. P. ESCHER

Physical questions in the "Wecker" patent. E. L. LEDERER. *Seifensieder-Ztg.* 56, 263-4(1929).—Calcs. are given for detg. how many degrees the temp. of an oil is decreased that has been heated to 250°, when 150 kg. H_2O of 80° is introduced per ton of oil. 88° denotes the temp. The amt. of heat required to maintain the oil temp. at 250° is 45,000 cal. = 9 kg. coal per ton of oil. Incidentally, the following b. ps. have been detd. for pure acids:

Barometric pressure	Stearic	Oleic	Palmitic
40 min.	267°	260°	252°
20 min.	247°	239°	231°

Mixtures of these acids have a higher m. p. than the m. p. calcd. from their % compn.

P. ESCHER

The "Wecker" patent. R. OCKEL. *Seifensieder-Ztg.* 56, 276(1929).—The only new idea in the "Wecker" patent is the introduction of cold H_2O into highly heated oil, and this was practiced by O. in 1901.

P. ESCHER

Beeswax. P. MARTELL. *Chem.-tech. Rundschau* 44, 1108(1929).—The sepn. of wax from honey is briefly described. The wax is then filtered while hot through cloth, the residue being further extd. with benzine or CCl_4 . Beeswax consists chiefly of palmitic acid, crude cerotic acid, myricyl ester and hydrocarbons amounting to 12-17%. The pure wax has a faint aromatic odor, is insol. in water and cold alc., completely sol. in boiling alc. from which it seps. on cooling, sol. in ether, benzine, CS_2 , CCl_4 , turpentine, Me_2CO and some ethereal oils. Fatty acids amount to 46-47%; sp. gr. 0.958-0.970, that of German beeswax being 0.960-0.966; m. 62-66.5°; acid no. 16.71-22.00; sapon. no. 82-103.69; I no. 6.1-13.01; ratio of acid no. to esters 3.02-4.03. Adulteration by ceresin or paraffin reduces the sapon. no. below 92. Bleaching of crude wax may be accomplished by sunlight, especially after addn. of turpentine, by Cl, $KClO_3$, $KMnO_4$, but is usually done by chromic acid. Adsorbents such as infusorial earth, flordin, etc., may be used. The uses of beeswax are briefly reviewed. E. P.

Liquid soaps. A. THIERM. *Chem.-tech. Rundschau* 44, 921, 957(1929); cf. C. A. 23, 2245.—Transparent aq. soap solns. are obtained by inhibiting as far as possible

hydrolysis of the soap with water with the formation of less sol. fatty acids. Oleic acid forms a water-stable soap; castor oil forms a still more sol. soap. The character of the fats used otherwise influences the soap; coconut and linseed oils have irritating effects on the skin and their soaps have odors masked with difficulty by perfumes, and agglutinating effects on hair. Me, Et, Pr alcs. and glycerol inhibit hydrolysis but also reduce foaming power. Addn. of 16% sulfonated castor oil increases stability to lime and also prevents hydrolysis. Neutralization of such soaps to phenolphthalein by addn. of sulfonated castor oil, filtration and adjustment of viscosity by addn. of a soln. contg. sugar, K_2CO_3 and KCl are recommended. E. PICKERING

Milled toilet soaps. EUGENE SCHUCK. *Am. Perfumer* 24, 397-8 (1929).—Milled toilet soaps contg. 60-65% fatty acids can be made by Welter's method of replacing part of the fatty acids with Na_2CO_3 ; it is the only practical method of making such soaps at small expense. The fatty acids are pumped into the Na_2CO_3 in a mixing machine in 2 portions to avoid swelling and at a temp. just above the m. p. In 20 min. the sapon. reaction is complete. The mixt. may be dumped on a cement floor to cool or run directly through the mill and plodder. With the former the proportion of Na_2CO_3 to fatty acids should be 48 to 50% and with the latter not over 42% Na_2CO_3 . By this process the percent of coconut oil in a milled soap may be increased to 100%. Dry sapon. can be applied to other than milled soaps and to soap powders. The advantages of the process are: Milled soaps can be made cheaper; they can be made much quicker; the scope of raw materials is much larger. Soaps made by this process are equally as good looking, durable and unchangeable as the old-style milled soaps. Samples of these soaps 6 years old have kept perfectly. E. SCHERUHEL

Colloidal lime soaps. E. SATER. *Chem. Umschau Fette, Oele, Wachse u. Harze* 36, 129-32 (1929).—Pure Na oleate, palmitate and stearate solns in the presence of $Ca(HCO_3)_2$, Ca sulfate or Ca chloride produced Ca soaps in colloidal form, flocculation setting in only after 50% excess of these electrolytes is present. In mixts. of oleate-stearate, oleate-palmitate and palmitate-stearate, the last was the most sensitive to electrolytes and in the presence of 100% excess of $Ca(HCO_3)_2$ complete pptn. of the Ca soap occurred. If the soap soln. was shaken with $Ca(HCO_3)_2$ soln., the Ca soap which remained in colloidal suspension amounted to 27.81%, but if some cellulose fiber was added during shaking, as little as 1-5% remained colloidal. Gelatin, gum arabic and carragen acted as protective colloids and kept Ca soaps in suspension, so that the troublesome pptn. of Ca soaps upon the washed goods can be prevented by their use. Agar-agar was pptd. with the soap. P. ESCHER

Antioxidizing substances and the ease of deterioration of perfumed and unperfumed soaps. VICTOR BOULEZ. *Parfumerie moderne* 22, 569, 571 (1929); cf. *C. A.* 21, 1556.—A brief discussion of the importance of proper selection of stabilizers for soaps. A no. of S compds have been found very suitable, particularly $Na_2S_2O_4$ and a more active compd. which B. calls "autoxyl". A. PAPINEAU-COUTURE

Soap losses in hard waters. R. KRINGS. *Seifensieder-Ztg.* 56, 285-7 (1929).—Fifty l. of Berlin tap water of 16° hardness (German°) ppts. 88 g. pure soap = to the total fatty acid content of 1 lb. of soap powder contg. 16% soap. If the Na_2CO_3 and Na silicate of this powder are separately dissolved in H_2O and the 16% soap is added afterwards, only $\frac{1}{2}$ of the soap will be pptd. and if this procedure is repeated with the addn. of the calcd. amt. of NaOH before the soap is added, then the total amt. of soap will go into soln. without being pptd. P. ESCHER

Lathering capacity and cleansing value. R. KRINGS. *Seifensieder-Ztg.* 56, 261-3 (1929).—Addn. of 3-5% of the newer fat solvents (methylhexalin, etc.) reduces the lathering capacity by 7-10% and increases the cleansing power by 30%. The wash effects of a soap include stability toward lime (hard water). Na soaps are least stable toward lime, forming bulky ppts.; K soaps are more stable, since the ppt. remains suspended in fine subdivision without being deposited upon the wash goods; addn. of fat solvents to Na soaps produces the same effect. A standard method for cleansing value should provide for a preliminary soaking of the goods in cold water. P. E.

The determination of unsaponified fat in soaps. O. SCHÖTTKE. *Seifensieder-Ztg.* 56, 245-6 (1929).—Dissolve 20 g. of the ground soap in an Erlenmeyer flask at 50° in 80-cc. alc. and 70-cc. H_2O in which 1 g. $NaHCO_3$ is dissolved, to neutralize any free NaOH. Cool to room temp., ext. 3 times in a separatory funnel with 70-cc. petr. ether (30-50°) and shake with 15 cc. 0.1 N soda and 15-cc. alc., then 3 times with 50% alc. and weigh the residue of free fatty acids, unsaponifiable matter and unsaponif. fat. Dissolve in 20-cc. neutral alc. and titrate with 0.1 N NaOH for free fatty acids; add 1-2 cc. 10 N KOH and saponify under reflux for $\frac{1}{2}$ hr. Add 18-cc. H_2O , cool and shake

3 times with 30-cc. petr. ether; wash with 10 cc. of 50% alc. 3 times and filter, dry and weigh as before, obtaining the unsaponifiable matter. Subtract the free acids plus unsaponifiable from the total residue to find the unsapon. fat. P. ESCHER

Physiol A I (disinfectant) as a soap supplement. G. POPP AND H. POPP. *Allgem. Öl-Feltsg.* 25, 183-4; *Chem. Zentr.* 1928, I, 2472.—Physiol A I is a white to gray, ropy, slimy filler for soaps. Its compn. is: moisture 92.2, ash 1.4, N-contg. substances 0.15 (calcd. as protein), invert sugar 0.02, after heating in an autoclave 3.9. Fats, starch, preservatives such as BzONa , etc., are absent. The product did not mold or deteriorate in 4 months and its efficacy is unquestioned. C. R. FELLERS

The determination of trimethylene glycol in crude and in dynamite glycerol. O. BERTH. *Seifensieder-Ztg.* 56, 269-73, 279-80 (1929).—Trimethylene is detd. in crude glycerol by calcn. from the difference between the results of the dichromate and acetin method. This method gives unreliable results for crude glycerol but more reliable results for dynamite glycerol. Fachini and Soinazzi's CO_2 method (*C. A.* 18, 645) gives the best results for crude glycerol. Cocks and Salway's distn. method (*C. A.* 16, 1376) requires too long a time for general use. With dynamite glycerol the methods are based on the difference between $100 - (\% \text{H}_2\text{O} + \% \text{glycerol}) = \text{trimethylene glycol}$. Cocks and Salway's distn. method gives good results if the errors in the acetin method are eliminated. Rojahn's method of calcn. from the $\% \text{H}_2\text{O}$ and sp. gr. gives excellent results by using Rojahn's tables and disregarding his correction of deducting 0.4% from the $\% \text{H}_2\text{O}$; reasons are given why his correction is inaccurate. P. ESCHER

A review of the technically important hydrotropic compounds (WILHELM) 18. Determination of the H value of unsaturated compounds (WATERMAN, *et al.*) 2. Effect of age on the apparent gain in weight of drying-oil films (MARLING) 26. Composition of α -eleostearic acid, the most important component of Chinese wood oil (BÖSEKEN) 10. Cotton seeds: their absorption of water and specific gravity (TURNER) 11D. Annotated bibliography on the storage of cotton seed and of seed cotton (STEECE) 11D. Removing oils, fats, etc., from fibrous and other materials (Brit. pat. 307,360) 13. Oil filter (U. S. pat. 1,728,305) 1. Condenser suitable for use in oil distillation (U. S. pat. 1,728,284) 1. Apparatus for separating oil and gas (U. S. pat. 1,727,733) 1. Apparatus for separating oil from compressed air, etc. (Brit. pat. 306,899) 1. Solvents and cleansing agents [and antiseptic soaps] (Fr. pat. 658,520) 18.

KRINGS, ROBERT: *Neuzeitliche Seifen und Waschmittel und deren Herstellung*. Ein Handbuch. Berlin: E. Maukisch 139 pp. Linen, M. 10.

Apparatus for extracting fats and oils from oleaginous materials. PROSCO OILS CORP. Fr. 659,034, Aug. 14, 1928.

Apparatus for extracting olive oil. MARC HUSSON. Fr. 659,798, Aug. 31, 1928.

Oils resistant to cold. ORANIENBURGER CHEMISCHE FABRIK A.-G. Fr. 659,209, Aug. 21, 1928. Oils resistant to cold are obtained by mixing foot oil and liquid fatty acids. The mixt. may be sulfonated and partly or wholly neutralized.

Emulsifying waxes. DEUTSCHE HYDRIERWERKE A.-G. Brit. 307,472, March 8, 1928. Wax-like materials such as spermaceti, the neutral portions of montan wax, paraffin, ceresin or ozocerite are incorporated with an alc. of high mol. wt. such as cetyl alc., wool-fat alcs., mono- or diglycerides of org. acids, together with a higher aliphatic acid or resin acid such as stearic or palmitic acid or colophony; the mixt. is emulsified with water or dil. alkali such as Na_2CO_3 and the products may be used in *refining fibers, waterproofing paper, making insecticides, lubricants, floor polishes*, etc.

Soap. ARTHUR E. HATFIELD AND EUSTACE A. ALLIOTT. U. S. 1,728,342, Sept. 17. See Can. 281,881 (*C. A.* 22, 3548). U. S. 1,728,343 relates to a cleaning or washing process in which a stable soap soln. is filtered and recirculated cyclically.

Soap threads. A. WELTER. Brit. 307,549, Nov. 14, 1927. Soap threads which are dry, non-caking and readily sol. are made by forcing solid soap at ordinary temp. through nozzles less than 1 mm. (preferably 0.4-0.5 mm.) in diam.

Detergent. GEORGE C. BRYSON. U. S. 1,728,721, Sept. 17. A mixt. suitable for use in cleaning the skin or delicate fabrics is formed of soap 400 grams, alc. 15 drams, glycerol 6 drams and the reaction products of oleic acid 14 drams and NaOH 1 gram.

28—SUGAR, STARCH AND GUMS

J. K. DALE

The centenary of Frédéric Alphonse Musculus. A. SARTORY. *J. pharm. Alsace Lorraine* 56, 168-71(1929).—Biography and review of M.'s work on starch and sugars. S. WALDBOTT

The composition of the fields 1928-1929 and the planting time of crop 1929. A. VAN LEER. *Arch. Suikerind., Mededeel. Proefsta. Java Suikerind.* III, 531-70(1929).—A statistical review in 14 tables of the varieties planted at each mill. P. R. P.

Statistics of the propagation and production of the varieties during crop 1928. A. VAN LEER. *Arch. Suikerind., Mededeel. Proefsta. Java Suikerind.* III, 571-679(1929). P. R. PEKELHARING

The sugar production of crop 1928. ANON. *Arch. Suikerind., Mededeel. Proefsta. Java Suikerind.* III, 505-30(1929).—A statistical review in 10 tables of the production of all mills grinding in 1928. P. R. PEKELHARING

Java cane in foreign countries. O. POSTHUMUS. *Arch. Suikerind.* 37, I, 400-9(1929).—An historical review of the import of Java varieties in other countries. P. R. PEKELHARING

The filtration problem in cane sugar factories. P. HONIG. *Arch. Suikerind.* 37, I, 420-31, 437-54(1929).—The theoretical points of the filtration problem are discussed and the advantages of the modern pressure- and vacuum-filters pointed out. P. R. PEKELHARING

Improvement of white sugar quality. J. DEINEMA. *Arch. Suikerind.* 37, I, 517-26(1929).—To improve the quality of plantation white sugar it is recommended to remelt the sugar of third and fourth strikes. Expts. showed that a temp. of 75-80° is required for remelting. In a carbonation mill the best result will be obtained by melting the sugar in hot clarified juice and mixing the soln. with a measured amt. of raw juice. Expts. showed that no trouble occurred at the carbonation and filter presses. The soln. was first neutralized with lime; no increase of liming at the carbonation was required. Color and grain of the product improved appreciably. Expts. were also carried out on returning the clear run-offs of the white sugar and mix with the remelt. Carbonation and filters did not cause any trouble if the mix was not higher than 24 Brix. As an av. 60-80% of clear run-offs could be returned. The quality of the product was also greatly improved by this process. P. R. PEKELHARING

Patents on continuous-working sugar centrifugals. J. J. W. DEN HAAN. *Arch. Suikerind.* 37, I, 500-16(1929).—A description and critical discussion of the patents of the last 4 years on continuous centrifugals. Conclusion. The construction of a centrifugal which is really continuous and leaves the sizes of the crystals intact would be very difficult. P. R. PEKELHARING

The clarification of concentrated sugar solutions. P. HONIG AND J. P. BOGTSTRA. *Arch. Suikerind., Mededeel. Proefsta. Java Suikerind.* III, 681-715(1929).—A survey is given of chem. and phys. methods for clarification of concd. sugar solns. To obtain a plantation white sugar of high quality, filtration of sirup and run-offs is necessary. Expts. at the carbonation mill Somobite showed that a mixt. of sirup clear run-off and dissolved molasses sugar was very well filtered by Kroog filters if 0.2% Hyflo Supercel on solids was added. Difference in compn. of the filter cake of sirup alone and of the mixt. showed that the clear run-off and the soln. of the molasses sugar contained more lime salts than the sirup. Quality of the sugar will be improved by elimination of the lime salts by filters or by separators. P. R. PEKELHARING

Taste and color of sugar. S. REUTERSKIÖLD. *Tek. Tid.* 59, Kemi 66-68(1929).—Refined sugar is sweeter than "white sugar," but the difference in actual sugar content is very small. Test: 3 g. sugar destroys ginger aroma in 100 cc. ginger ext. if not refined. Color absorption of sugar solns. should be tested in red or yellow light. Bone black from unextd. bones is better for decolorization of sirups than activated carbon or bone black from extd. bones. G. R.

The behavior of phosphoric acid during liming and saturation in relation to natural alkalinity. O. SPENGLER AND A. TRÄGEL. *Z. Ver. deut. Zuckerind.* 79, 457-62(1929); cf. C. A. 22, 4860.—Expts. show that with a natural alky. of 0.004-0.1% in the 1st and 2nd satn., phosphoric acid is almost completely pptd. If a large amt. of phosphate is found as a deposit in the 1st body of the evaporators, it is probably because the H_2PO_4 compd. in the form of Ca glycerophosphate has not been decompd. owing to inadequate liming. The org. H_2PO_4 salts then remain in soln., especially if the natural

alky. is low, and finally deposit as insol. H_3PO_4 compds. in the 1st body. An analogous case occurs with oxalic acid, where, if the natural alky. is not high enough, Ca oxalate is not transformed into the harmless sol. Na salt.

F. CAMPS-CAMPINS

Coloring matters of beet molasses. M. GARINO, A. REGÈ AND F. RUBINO. *Giorn. chim. ind. applicata* 11, 61-3(1929).—The coloring matters in beet molasses fall into 2 groups: those produced in the caramelization of the sugar, and those produced by the action of lime on the inverted sugar.

A. W. CONTIERI

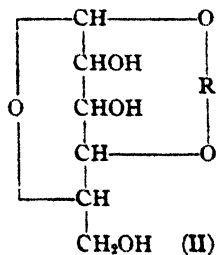
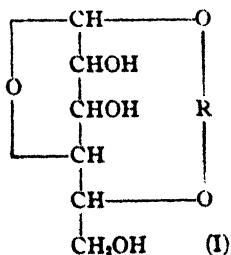
Decolorizing carbons and their action on the coloring matters of beet molasses. M. GARINO AND A. REGÈ. *Giorn. chim. ind. applicata* 11, 64-7(1929).—The following forms of C were used: Animal charcoal, washed animal charcoal, antichromos, "appula," carboraffin, norite. The coeffs. of adsorption of carmelane, carmelline, as well as of the Ca salt of apogluic acid, were detd. Conclusion: The adsorption depends not only on the surface of the C used and the surface tension of the liquid medium, but also on the quality of the surface.

A. W. CONTIERI

Physico-chemical analysis of massecuites. D. SIDERSKY. *Bull. assoc. chim. sucr. dist.* 46, 272-7(1929).—Refractometric methods for the analysis of massecuites are reviewed and discussed.

F. CAMPS-CAMPINS

Chemistry of starch. JAMES C. IRVINE. *Rec. trav. chim.* 48, 813-6(1929).—Three distinct compds. are recognizable as the essential products of the methylation of starch, viz: *dimethylstarch*, giving 2,3-dimethylglucose on hydrolysis; *methylated starch with OMe = 37%*, giving a mixt. of 2,3-dimethyl- and 2,3,6-trimethylglucose on hydrolysis; *trimethylstarch*, giving only 2,3,6-trimethylglucose on hydrolysis. In this respect starch shows an exact parallelism with glycogen and also certain similarities with inulin, but differs markedly from cellulose where methylation proceeds regularly until the formation of trimethylcellulose, which, on hydrolysis, gives 2,3,6-trimethylglucose. This sugar, however, possesses the tendency to exist in 2 interconvertible forms, a butylene-oxidic and an amylene-oxidic one, a fact which renders it an uncertain reference compd. in structural studies. Thus, it follows that one and the same methylated sugar could arise from 2 entirely different types of parent compd., viz. I and II. As 2,3,6-trimethylglucose is the only methylated sugar produced in the reactions under discussion, it follows that the group R, if present, must be structurally identical with the glucose residue to which it is attached, and starch can therefore be regarded as a polymerized anhydride of a polyglucose contg. the OH groups 2, 3 and 6 unsubstituted. Ambiguity still remains as to the particular type to which starch belongs, but probably the O-ring in the mol. is different from that in cellulose. The complexity of the problem is further revealed from the fact that α -tetraamylose on methylation behaves in the same way as starch and thus reacts in an entirely different manner from hexaamylose. Although it is customary to regard the polysaccharides based on glucose as polymerides of anhydrides contg. at least 2 glucose residues because of the conversion of starch and cellulose into maltose and cellobiose, resp., I. does not think it impossible that these polysaccharides are polymerides of isomeric anhydrides of α - and β -glucose in which O rings couple at positions 1 and 4 and 1 and 5, resp.



C. F. VAN DUIN

New yield tables for potato starch. SPROCKHOFF. *Z. Spiritusind.* 52, 191(1929).—Tables are given showing the amt. of starch obtained and the amt. of potatoes necessary to prep. a definite amt. of starch based on the starch value of potatoes and conditions of manuf.

A. SCHULTZ

Starch. II. Potato starch. KURT HESS AND FRANKLIN A. SMITH. *Ber.* 62B, 1619-20(1929); cf. Friese and S., *C. A.* 23, 302.—It was shown in the 1st paper that potato starch previously treated with C_6H_5N takes up 3 Ac groups per $C_6H_{10}O_5$ residue with $C_6H_5N \cdot Ac_2O$ at 50-70°. The influence of the preliminary treatment depends on the swelling of the starch, which is conditioned by the H_2O content of both the starch

and the C_6H_5N . Anhyd. starch (dried at 100° and 16 mm. over P_2O_5) does not swell in abs. C_6H_5N , but air-dried starch (16.6% moisture) does and in 80% C_6H_5N it swells somewhat more while anhyd. starch swells still more in 80% C_6H_5N . Starch swollen } ways is readily converted into the tri-Ac deriv. with C_6H_5N -
-igl and Schinle state (*C. A.* 23, 2426) that starch acetylated
"to a homogeneous viscous soln."

relative amts. of ...
at the end of the reaction, expts. were run with varying amts. of ...
in no case did the product form a homogeneous soln. in $CHCl_3$, while the acetate obtained from amylose (fraction 1 of the 1st paper) readily dissolved to a clear homogeneous soln.; H. and S. cannot agree with the view that the F. and S. method gives products which do not differ in their behavior toward solvents from those obtained from starch paste or "amyloses" secured by H_2O extns. They believe that their method, especially in its new form (at room temp.), is the mildest hitherto proposed for prep. acetyl starch (cf. also Haworth, Hirst and Webb, *C. A.* 23, 818; Tsuzuki, *C. A.* 23, 2425) and offer assurance that the starch is acetylated without chem. degradation. It was shown in the 1st paper that appreciable amts. of carbohydrates can be removed from natural starch by treatment with H_2O below the swelling temp. The starch granules decrease in diam. but otherwise their appearance does not change under the polarizing microscope and it would seem as if the starch substance is removed in layers from without by the H_2O , an observation contrary to the old view that a hull, forming a very considerable portion of the starch granule, must be ruptured before H_2O can remove the sol. amylose lying in the interior of the granule. A part of the dissolved carbohydrate is hydrolyzed in the operation; the reducing portion can be sepd by fractional pptn. with alc. and the non reducing fractions correspond to preps. having the properties of starch amylose. The investigation has not been completed but a few addnl. data are given. When fraction 5 of the 1st paper, with a reducing power 11.8% that of glucose, was boiled 23 days in 1% aq. soln. the reducing power rose to 25.6%, the rotation fell from 141.9° to 120.0° and the p_H of the H_2O changed from 6.12 to 4.52, indicating that the hydrolysis of amylose to reducing substances is accompanied by a considerable increase in acidity. When natural starch is extd. with hot H_2O , the p_H of the H_2O also changes but the change is irregular and bears no relation to the amt. of carbohydrates going into soln., which depends only on the temp.

C. A. R.

Drives for Weston centrifugals (HOPFERWIESER) 1. Beet flies in 1928 (KAUFMANN) 15. Reports on pathology [of sugar cane] (CARPENTER, *et al.*) 15. The manufacture of paper pulp from bagasse (CONNON) 23. Report on chemistry [of sugar cultivation] (STEWART) 15. Investigations on the biology and the extermination of the Walang Kongkang (ROLLE, STAMMESHAUS) 15. Saponification of acetylated sugars and related substances (ZEMPLÉN, PACSU) 10. Some properties of sugar anhydrides (PICTET, VOGEL) 10. The treatment of the waste waters of a sugar factory with Cl (NOLTE) 14. Rendering of the waste waters of beet sugar factories harmless (HIRSCHFELDER) 14. The ecology of growing beets with respect to disease (STEHLIK, NEUWIRTH) 11D. Purification of effluents from beet sugar factories (GENNERICH) 14. Pure cellulose from bagasse (U. S. pat. 17, 422) 23.

HEMPRICH, M.: Die Nebenprodukte des Zuckerrübenbaues und ihre rationelle Verwertung. Berlin: Paul Parey. 116 pp. M. 4.50. Reviewed in *Chimie & industrie* 22, 220(1929).

Sugar. GIUSEPPE ODDO and VINCENZO DE FONZO. Fr. 658,796, July 26, 1928. Sugar is extd. from vegetable products, particularly carobs, by disintegrating and treating with org. solvents such as alcs., acetone, etc.

Purifying sugar juices. GERHARD E. VAN NES. U. S. 1,727,738, Sept. 10. See Brit. 295,831 (*C. A.* 23, 2319).

29—LEATHER AND GLUE

ALLEN ROGERS

Chemical research in the tannery field. K. H. GUSTAVSSON. *Tek. Tid, Kemi* 59, 68-79 (1929).—A review of recent investigations in the chemistry of proteins, neutral salt effect in a protein system, theoretical chemistry of leather proteins during the tanning process, removal of hairs, curing and vegetable and chromium tanning is given with discussion of the results and theories of the most important investigators.

GERHARD RUBEN

Native tannin production. TH. KÖRNER. *Ledertech. Rundschau* 21, 132-5, 142-5 (1929).—Willow cultivation is discussed.

I. D. CLARKE

Pine bark and the manufacture of extra-quality pine bark extracts. P. A. YAKIMOV. *Collegium* 1929, 334-56.—A study was made of the factors affecting extn. The best ext. from chips was obtained at 90° in 10-12 hrs. A refined ext. can be made by soaking the bark in a slow stream of H₂O for 24 hrs., pressing and then chipping and extg. The soaking removes 30 to 50% of the nontannin and not more than 10% of tannin. Sulfiting increases the purity and tannin content, the best method is to treat the ext. 20-25 hrs. at 96° with a mixt. of Na₂SO₃ and NaHSO₃ equal in wt. to 30-45% of the insolubles. The purified ext. penetrates much more rapidly and differs in other ways from the unpurified. The latter ferments readily and so cannot be shipped safely.

I. D. CLARKE

Determination of basicity of chrome extracts. C. M. LEVIT. *Vestnik Kozhevennoi Prom. i Torgovli* 1927, 342. Tables show the comparative value of Shorlemmer's method of detn. of Cr₂O₃ in chrome liquors and of the KMnO₄ method. The Na₂O₂ method is unsuitable for liquors contg. glucose or contaminated with org. matter. The KMnO₄ method of detn. of Cr₂O₃ gives more concordant results and gives figures which differ negligibly from the more accurate gravimetric method. L. recommends the KMnO₄ method for routine laboratory practice.

B. MONSAROFF

The precipitation number of basic chrome alum liquors. WILHELM SCHINDLER AND KARL KLANFER. *Collegium* 1929, 282-300.—The pptn. quotient (*Q*) is often a better measure of the astringency of a liquor than the pptn. no. (*P*). $Q = \{\text{difference between } p_H \text{ at the pptn. point and original } p_H \text{ of the liquor}\} \div P$. On aging 45% basic liquors, *Q* and *P* are influenced considerably by temp. (*Q* increases as temp. rises) but very little by the concn. or method of addn. of soda. The *Q* of 25% basic liquors was almost unchanged by these factors. Small quantities of metallic Fe increased the basicity appreciably.

I. D. CLARKE

One-bath tanning extracts from peat. MICHAILENK-MALENKO. *Vestnik Kozhevennoi Prom. i Torgovli* 1928, 31. Humic acid contained in peat can be converted into a synthetic tanning material by oxidation. It can be used also advantageously as a reducing agent for K₂Cr₂O₇ in prepn. of one-bath tanning liquors. The resulting tanning ext. has better tanning properties than glucose-prepd liquors and it is much cheaper. Leather tanned with peat reduced liquors resembles those which are tanned by the two-bath process. The dichromates are reduced in the presence of CuSO₄ + 5H₂O as a catalyst. The quantity of peat necessary to reduce dichromates is such that the ratio of humic acid to K₂Cr₂O₇ is 1:2. Only peats with a low ash content and a humic acid content not less than 50% can be used.

B. MONSAROFF

The influence of tanning materials on the degree of dissociation of acids. N. CZERNOV AND S. SIPIN. *Vestnik Kozhevennoi Prom. i Torgovli* 1927, 285.—Solns. of H₂SO₄, HCl, AcOH and lactic acid (0.02 N) in 1° solns. of mangrove, mimosa bark, ordinary quebracho, sulfited quebracho, valony and spruce extracts were studied. The H-ion concn. of weak acids is lowered much more by tanning exts. than is that of strong acids.

B. MONSAROFF

The double refraction of tanned collagen fibers depending on shape. A. KÜNTZEL. *Collegium* 1929, 207-14; cf. *C. A.* 20, 1337, 2919.—A tanned fiber differs from an untanned one in that reagents such as aniline, clove oil and nitrobenzene no longer cause reversal of the double refraction. This fact together with the fact that some tannins cause reversal of the micellar double refraction show that the tannin is fixed within and not between the micellae. Therefore, the collagen micellae react with the tannin causing a change in the lattice structure and so in the optical constants of the lattice.

I. D. CLARKE

The influence of neutral salts on the enzyme activity of trypsin bates. I. Influence of ammonium sulfate on the digestion of casein by pancreas extract. V. KUBELKA AND J. WAGNER. *Collegium* 1929, 328-34; cf. *C. A.* 23, 4592.—The action

of trypsin on casein is increased greatly by $(\text{NH}_4)_2\text{SO}_4$. At low salt concns. the increase is about proportional to the quantity of salt. Between 200 and 400% of salt, on the pure enzyme basis, the activity reaches a max. and is then const. with greater quantities of salt. If more than 33% of $(\text{NH}_4)_2\text{SO}_4$ is present in a bate prepn., and this is almost always the case, the salt content need not be adjusted before analysis.

I. D. CLARKE

Influence of barium sulfate and silica upon the physical properties of delimed hides. G. POVARNIN AND M. KUROVSKII-STARINSKII. *Vestnik Kozhevnooi Prom. i Torgovli* 1927, 337.—By treating delimed hides with 1.4% of $\text{Ba}(\text{OH})_2$ the filling of leather is increased with the increase of hide concn. of the $\text{Ba}(\text{OH})_2$. Na silicate increases also the filling, but only up to a concn. of 5%. $\text{Ba}(\text{OH})_2$ fills the leather better than Na silicate. On treatment of the hide with $\text{Ba}(\text{OH})_2$ absorption takes place, probably accompanied by some hydrolysis of the hide at the end of the operation. The action of SiO_2 on the hide is probably chem. The temp. of coagulation or curling of the hide is lowered by $\text{Ba}(\text{OH})_2$ only 4.5. SiO_2 lowers the temp. of curling as much as 17°. The tensile strength of the hide is lowered in proportion to the amount of BaSO_4 and SiO_2 absorbed by the hide. The water absorption is decreased with the increase of filling the hides with SiO_2 . BaSO_4 increases the water absorption; this can be explained by partial hydrolysis of the hide by $\text{Ba}(\text{OH})_2$.

B. MONSAROFF

Treatment of chrome leather. J. W. LAMB. *Dyer, Calico Printer* 62, 81-5 (1929).—The production of chrome leather by the single-bath tannage and the double-bath tannage is described. Suggestions are given for the dyeing of chrome leather with regard to the selection of the dyestuff and its application.

R. K. WORNER

Red and blue stains on moist chrome leather. MAX BERGMANN AND FRITZ STATHIER. *Collegium* 1929, 326-7.—Small red and blue spots on moist, unfinished chrome leather were caused by *Actinomyces*.

I. D. CLARKE

Fast colors on leather. M. C. LAMB. *Chem. Age* (London) 21, No. 533 (Dyestuffs Monthly Suppl.) 19-21 (1928).—Some suggested lines of future development.

E. J. C.

Influence of temperature on the tensile strength of dry leather. B. POVARNIN AND F. SAPEGIN. *Vestnik Kozhevnooi Prom. i Torgovli* 1927, 278-81.—The higher the temp. to which the leather is subjected in the boiling test, the lower is its resistance to dry heat. Dry calf skin lost only 22.32% of its tensile strength and only 5.47% on the modulus of resiliency. Chrome-tanned calf skin lost 83.06% of its tensile strength and 65.20% of its resiliency. The changes were not so pronounced in oil-tanned leather, the tensile strength of which was diminished by 44.4% and resiliency by 48.16%. Changes in the elongation coeff. were, for dry untanned calf skin 24%, for chamois 26.9%, for vegetable tan 42.9%, for chrome tan 49.9%. Chrome-tanned leather is the least stable with relation to changes in temp., dry non-tanned leather is the most stable. The disintegration limit for dry non-tanned calf skin was above 70°. For vegetable tanned leather at 70° there was observed a considerable diminution of its tensile strength. For chrome-tanned leather the loss of tensile strength took place above 60°.

B. M.

Leathercloth and rubbercloth. W. E. FIGGIS. *Chem. Eng. Mining Rev.* 21, 413-7 (1929).—A description of the new I. C. I. factory at Deer Park, Victoria.

E. J. C.

The liming of leather scrap for making glue. FRITZ BAUM. *Kunstdunger-u. Leim-Ind.* 25, 97-9; *Chem. Zentr.* 1928, I, 3142.—The use of a 0.18% $\text{Ca}(\text{OH})_2$ soln. is recommended.

C. R. FELLEKS

The treatment of hides and the manufacture of glue and leather fat from the waste products. TORSTEN SÖRENSEN. *Tek. Fören. i Finland Forh.* 49, 142-9 (1929).

H. C. DUUS

Progress and new inventions in the glue industry during 1928. R. KISSLING. *Chem. Umschau Fette, Öle, Wachse Harze* 36, 268-71 (1929).—A brief review of the literature with 72 references as footnotes.

P. ESCHER

Premature deterioration of gas meter diaphragms [of leather] (ANTHES) 21. Glue and gelatin and their uses in the textile industry (TROTMAN) 25. Rubber compositions [leather-like products] (Brit. pat. 306,994) 30. Dyes [for leather] (Fr. pat. 659,526) 25. Coating and filling composition from disintegrated leather (U. S. pat. 1,728,391) 18. Diastatic extract [for use in tanning] (Brit. pat. 307,055) 11E. Tank and circulating system for separating glue pellets from liquids (U. S. pat. 1,720,547) 1.

Leather tanning. RÖHM & HAAS A.-G. Ger. 482,139, Nov. 14, 1926. An emul-

sion for leather tanning consists of fat or oil, water and a freshly pptd. metal hydroxide such as $\text{Al}(\text{OH})_3$. Urea may also be added. Examples of such emulsions with the proportions of the constituents are given.

Tanning extract. PAUL ALEXSSANDROWITSCH JACKIMOFF. Ger. 482,140, Mar. 2, 1928. Tannin is lixiviated with water at temps. between 1° and 5° to remove non-tanning matter, and is then extd. with water at higher temps. The cold extract contains sugar which may be worked up into alc. or acid in the usual way.

Tanning agents. I. G. FARBENIND. A.-G. Fr. 658,874, Aug. 10, 1928. Synthetic tanning agents are obtained in the solid state by mixing the alkali salts of those condensation products of phenols contg. S, which are not pptd. from aq. soln. by dil. acids, with solid org. or inorg. acids or substances yielding acids in proportions such that their aq. solns. possess the acidity necessary for tanning. Examples are given in which condensation products obtained by the action of CH_2O and sulfite on sulfuration products of PhOH are mixed with oxalic acid, 2-naphthalene sulfonic acid or KHSO_4 . Cf. C. A. 23, 1008.

Tanning agents. J. R. GEIGY AKT.-GES. Fr. 660,008, Sept. 5, 1928. See Brit. 305,013 (C. A. 23, 4844).

Images produced by tanning agents. KALLE & CO. A.-G. Fr. 659,749, Aug. 21, 1928. Images produced by tanning agents are obtained by applying on a supporting layer a mixt. of a diazo compd. and an org. compd. in the presence or not of a pigment or stabilizer, exposing the layer to light, treating with a tanning agent and developing the image with water.

Chromium tanning agent. GEORG KRÄNZLEIN, ARTHUR VOSS and FRANZ BRUNN-TRÄGER (to General Aniline Works). U. S. 1,727,719, Sept. 10. A tanning agent easily sol. in water comprises a Cr sulfate having a basicity of about 33–50% and MgSO_4 .

Artificial tanning material. HERMANN SCHÜTTE (to I. G. Farbenind. A.-G.) U. S. 1,727,135, Sept. 3. S is condensed in the presence of an alk. agent with a condensation product of a phenol, CH_2O and a salt of sulfurous acid such as Na_2SO_3 .

Leather dressing compositions. HANSEATISCHE MÜHLENWERKE A.-G. and B. REWALD. Brit. 306,672, Jan. 23, 1928. Phosphatides or lecithins (other than egg yolk), such as those of soy beans, are used with oils for facilitating absorption by the leather. Water and a small quantity of alkali or soap may be added. Various examples are given.

Leather substitute. RENE CLAVEL. U. S. 1,727,862, Sept. 10. Cellulose acetate material which may be in hank or fabric form is treated with a phenolic compd. such as a tannin and the material is further subjected to washing, treated with a heavy metal salt such as a salt of Bi, Zn, Ag or Fe, dyed and treated with a finishing soln., *e. g.*, paraffin or other oil. Cf. C. A. 22, 1249.

Fibrous product suitable for use as a leather substitute. FRANK T. LAHEY. U. S. 1,726,905, Sept. 3. A semiporous material comprises mordanted fibers such as cotton treated with $(\text{NH}_4)_2\text{SO}_4$ or a tannate mixed with a rubber-like colloid, *e. g.*, a liquid latex or a soln. of rubber in oil, and may be molded while moist.

Artificial leather. THE MECHANICAL RUBBER CO. Fr. 658,793, July 23, 1928. Vegetable fiber is hydrolyzed to a gelatinous state and rubber from an aq. dispersion is coagulated thereon, a relatively thick damp sheet being formed, which is pressed. Cf. C. A. 23, 2320.

Imitation suede leather. C. E. SIMPSON. Brit. 306,693, Feb. 11, 1928. The smooth side of a *velour cloth* of fine texture is coated with a soln. of cellulose acetate or nitrocellulose or mixts. of these to form a flexible backing. Various auxiliary treatments are described. Cf. C. A. 23, 1304.

Solidifying glue, gelatin, etc., by solidifying pellets of the material on a cold surface. BRITISH GLUES & CHEMICALS, LTD., and R. B. DREW. Brit. 306,622, Dec. 1, 1927. The cooling surface is covered with snow or ice shavings, which prevent adhesion. An app. is described.

30—RUBBER AND ALLIED SUBSTANCES

C. C. DAVIS

Latex. ST. REINER. *Chem. App.* 16, 96(1929).—A general discussion of the structure of latex, its coagulation, industrial uses and transportation. M. C. R.

Berginization of crude rubber. H. I. WATERMAN, R. H. DEWALD AND A. J. TUL-

LENERS. *Erdöl u. Teer* **22**, 403-4(1929).—Samples of 150 g. first latex crepe were heated to 450° for 15 min. with and without an initial H pressure of 110 kg. per cm. With max. pressures of 250 and 50 kg., resp., the results were: *C* residue, 0, 1.6%; oil b. < 220°; 43.8%, 39.9%; Br. no. 40, 34; n_D^{20} 1.45, 1.46; aniline pt. 21°, 4°; oil b. 220-300°, 23.5%, 20.7%; Br. no. 13, 13; n_D^{20} 1.502, 1.519; aniline pt. 23.5°, 4°.

A. W. FRANCIS

Heats of combustion of rubber, gutta-percha and balata. T. H. MESSENGER. *Trans. Inst. Rubber Industry* **5**, 71-86(1929).—It was thought that measurements of the heats of combustion of rubber, gutta-percha and balata might throw light on the unsettled problem of the difference in constitution of these 3 substances. At the same time, the effect of mastication on the heat of combustion of rubber was detd. The 3 substances were extd. with cold water, dried *in vacuo*, extd. with AcMe, dissolved in C_6H_6 , filtered, pptd. with abs. EtOH, dissolved in $CHCl_3$, repptd. with AcMe, and extd. with boiling AcMe, then with water and finally dried, all the treatments being carried out in the absence of air. The combustions were made in an O bomb and calorimeter of standard type. The av. heats of combustions of rubber, gutta-percha and balata were 10,970, 10,990 and 11,000 cal. per g., resp., showing the close similarity in chem. properties of the 3 substances. Rubber was then disaggregated in 2 ways: (1) by mech. mastication, and (2) by exposure to sunlight, and the heats of combustion of the products were detd. in comparison with that of the original rubber. Though in each treatment the rubber was disaggregated to such an extent that the soln. viscosities in C_6H_6 were lowered to relatively insignificant values, the heats of combustion remained unaltered, showing that internal mol. changes (depolymerization) do not occur either during milling or exposure to sunlight, and that the changes observed are the result of phys. changes in the state of aggregation. A discussion of the *C/H* ratio in rubber, gutta-percha and balata, based on a survey of the literature, indicates the validity of the C_5H_8 ratio. The expts. of M. give the empirical formula $C_{10}H_{16}$ for balata.

C. C. DAVIS

The permeability of rubber mixings. W. CECIL DAVEY AND T. OHYA. *Trans. Inst. Rubber Industry* **5**, 27-30(1929).—Expts. on the relative permeability to H of vulcanizates contg. (1) rubber and S; (2) rubber, S, accelerator, ZnO; (3) rubber, S, accelerator, ZnO, stearic acid; (4) rubber, S, accelerator, ZnO, antioxidant; (5) rubber, S, accelerator, ZnO, softeners; and (6) rubber, S, accelerator, ZnO, stearic acid, and pigments or fillers, showed that the permeability is lower in accelerated than in unaccelerated mixts.; that it is lowered still further by softeners and by antioxidants; and that it is increased by mineral fillers. With the finest pigments, however, the increases are relatively small. Before curing, the permeability of the mixts. was much lower than after curing. An *app* designed especially for measuring the permeability of rubber is described and illustrated.

C. C. DAVIS

The aging of cotton contained in rubber goods. GUY BARR. *Trans. Inst. Rubber Industry* **5**, 31-47(1929).—The article describes a variety of expts. which have been carried out by B. and by others in the past on the *natural and artificial aging of rubberized balloon fabrics*. Expts. on the *comparative effects of ultra violet light and of tropical sunlight* showed that there are essential differences between the 2 effects. Losses in tensile strengths of the fabrics were similar, but though the permeability of the samples exposed to ultra-violet light remained the same, the samples exposed to sunlight became extremely permeable and their H_2SO_4 content became relatively large. Ultra-violet light caused disproportionately great deterioration of the cotton, whereas tropical sunlight acted relatively rapidly on the rubber and S, with formation of H_2SO_4 , which in turn attacked the cotton. Since the phys. and chem. effects were so different in ultra violet light and in sunlight, an ultra-violet light test is useless for foreseeing the behavior of rubberized fabrics in sunlight. Org. dyes and inorg. pigments afford protection on exposure of cotton to sunlight, $PhCrO_3$ giving the best results. Expts. in which unrubberized cotton was exposed to radiation of different wave lengths showed that deterioration occurred only in violet and in near-ultra-violet light and that filters which absorb all radiation below 4000 Å. U. afford almost complete protection. A good idea of the efficiency of screens in absorbing from sunlight radiation injurious to cellulose may be had by comparing their behavior with Velox or other AgBr paper, max. deterioration of the cellulose occurring with the same radiation which causes the max. effect on AgBr. The deterioration of cotton in sunlight is essentially oxidation, the cotton acquiring the reducing properties of oxy-cellulose. Graphs show the losses of strength of cotton exposed for increasing times to 0.0005 N, 0.00025 N and 0.000125 N H_2SO_4 , and then heated at 110°, 119° and 127°, resp., for 1-16 days. At a given temp. the

rate of loss of strength was roughly proportional to the wt. of acid in the fabric. With a given acid content the rate of loss of strength doubled with an increase of temp. of 8°. A general discussion follows the paper. C. C. DAVIS

Some observations on carbon black. C. M. CARSON AND L. B. SEBRELL. *Ind. Eng. Chem.* 21, 911-4(1929).—By studying the adsorptive capacity for accelerator, the effects of heat, the reaction with S and ZnO and the dispersion (rate of settling) of different types of C black, it was possible to correlate their behavior in these respects with their effects in vulcanized rubber. The adsorptive capacity is a measure of the rate of vulcanization of rubber mixts. contg. the blacks, C blacks with low adsorptive capacities giving faster curing mixts. than blacks with high adsorptive capacities. Heating C blacks to 500–1200° rendered them highly adsorptive, and also made the rubber mixts. contg. them vulcanize faster and have higher moduli than the same mixts. contg. the corresponding unheated blacks. With S and ZnO in boiling xylene, C blacks liberate a substance having an accelerating action. An indication of the stiffening action of a C black may be had by detg. in a thin rubber cement the quantity which is dispersed to an extent where it cannot be centrifuged out again under definite conditions. C. C. D.

Comparison of acetylene black with gas black and lamp black. T. R. DAWSON AND N. H. HARTSHORNE. *Trans. Inst. Rubber Industry* 5, 48-70(1929).—Systematic expts. were carried out to compare the phys. and chem. properties of 2 American gas blacks, 2 lamp blacks and a Canadian acetylene black, and their effects in different proportions in unaccelerated and in accelerated rubber mixts. The comparative analyses of their phys. and chem. properties are described in detail. In unaccelerated mixts., gas black was intermediate in behavior between acetylene black and lamp black, except for tensile strength and reinforcing power, in which respects the gas blacks and acetylene black were almost the same. In properties related to strength, such as rigidity, absorption of energy and hardness, the gas and acetylene blacks were relatively close together, with the lamp blacks showing considerably different properties. In properties related to elasticity, such as permanent set and resilience, the gas blacks approached the lamp blacks, the acetylene black standing apart. The following data give the % difference from the lamp black in the tensile strength, elongation at 0.75 kg. per sq. mm, rigidity (kg. at 300% elongation), energy absorption, permanent set, hardness and resilience of the gas blacks and the acetylene black, resp.: 26, 23; -3, -11; 20, 34; 40, 40, 50, 120; 25, 35; -3, -9. The results show that each type of C black has advantages for certain definite purposes. When comparing blacks of distinctly differing types, tensile strength, energy absorption, permanent set and hardness are most useful, while in comparing blacks of similar type or in detg. the variability of a single black, elongation, rigidity, permanent set and resilience (those properties which differ greatly) are most useful. Permanent set is recommended as a particularly useful criterion. In accelerated mixts the gas blacks were again intermediate in effects between the lamp blacks and acetylene black, approaching more nearly acetylene black. With the accelerated mixts. there was very little leveling of the differences found among the blacks in the unaccelerated mixts., which is contrary to general belief. The lamp blacks had a relatively great weakening effect on the activity of the accelerators, and this to a degree which varied with the individual accelerator. An investigation of the variation in successive lots of the same acetylene black showed that the differences in quality may be as great as the differences between gas black and acetylene black, but that they are smaller than those between lamp black and acetylene black. A general discussion follows the paper. C. C. DAVIS

The use of Thénard blue in accelerated rubber mixtures. RUDOLF DITMAR AND HEINZ PREUSSE. *Gummi Ztg* 43, 2749-50(1929).—Thénard blue is stable during S vulcanization without accelerators, in S₂Cl₂ vulcanization either as vapor or in CS₂, in vulcanization by ultra-violet light, and in vulcanization with S in air. It shows compatibility with most accelerators, though it activates some (e. g., the butyraldehyde condensate of dimethyl-*p*-phenylenediamine) and cannot be used with others (e. g., aldehyde-ammonia). It cannot be used for coloring hard rubber. C. C. DAVIS

Titanium white or lithopone? ERICH WURM. *Gummi-Ztg.* 43, 2752(1929).—Expts. during the past 3 yrs. by W. do not support the contention that TiO₂ is more economical than lithopone in rubber. Based on the relative costs and coloring power lithopone is the more economical, and furthermore vulcanizes contg. lithopone age considerably better than the corresponding vulcanizates contg. TiO₂, particularly with products cured with S₂Cl₂. Examn. of TiO₂ from different sources showed that all contained traces of Ti. It is considered that lithopone is much preferable to TiO₂ as a white pigment for rubber goods. C. C. DAVIS

The coloring of rubber. G. MARTIN. *Rev. gén. mat. color.* 32, 213-9(1928).—The dyeing of rubber in bulk and by surface coloring is discussed, together with the methods of application and dyes suitable for each. ROBERT HOUGHTON

Rubbercloth (FIGGIS) 29. Thermic behavior of the phenols and bases of brown coal tar (RUHEMANN) 21. Electrodeposition [of rubber] (CORBIN) 4. Rubberized cloth (Fr. pat. 658,811) 25. Bituminous compositions [using rubber or rubber latex] (Brit. pat. 307,466) 22.

Concentrating latex, etc. DUNLOP RUBBER CO., LTD., D. F. TWISS and E. A. MURPHY. Brit. 307,315, Nov. 3, 1927. Liquids such as latex, liable to suffer coagulation, skin formation or like changes during evapn., are concd. with or without admixt. of stabilizers, accelerators, preservatives, etc., in an app. which is described and which keeps the material in motion in a rotatable and oscillating receptacle having a temp.-regulating jacket. A latex mixt. to be concd. may be composed of rubber 71.6, S 2.5, accelerator 5, ZnO 2, Fe oxide 3, mineral oil 7, whiting 6, china clay 6.7, oleic acid 0.2, casein 0.1 and KOH 0.4 part.

Reversible concentrated latex. PAUL SCHOLZ. U. S. 1,729,522, Sept. 24. A reversible concd. latex contains about $1/8-1/2\%$ of salicylic acid or a salicylate. Small proportions of KOH, K soap, etc., also may be added.

Composition comprising latex or other rubber dispersions. DUNLOP RUBBER CO., LTD. and R. C. DAVIES. Brit. 306,621, Dec. 1, 1927. Finely divided fillers such as "gas black" are dispersed in an aq. or slightly alk. soln. of cellulose xanthate, for incorporation in latex, etc., which may be vulcanized. Other compounding ingredients may be added to the xanthate or latex.

Rubber. I. G. FARBENIND. A.-G. Fr. 658,757, May 5, 1928. Inorg. salts of dithiocarbamic acids sol. in water, are used as *accelerators* in the vulcanization of natural or artificial rubber.

Natural and synthetic rubber. I. G. FARBENIND. A.-G. Brit. 307,375, Dec. 5, 1927. Rubber is coagulated from emulsions of synthetic rubber or mixts. of these with natural lattices, by use of proteolytic enzymes. Various details and examples are given.

Synthetic rubber. I. G. FARBENIND. A.-G. Brit. 307,308, March 3, 1928. In polymerizing butadiene or similar hydrocarbons, the polymerization is conducted in successive stages with intermediate interruptions at which further addns. of the same or a different hydrocarbon to be polymerized may be made. Various details and examples are given. Cf. C. A. 23, 4848.

Synthetic rubber. I. G. FARBENIND. A.-G. Fr. 658,652, Aug. 7, 1928. Rubber is obtained by polymerizing butadiene hydrocarbons in the presence of other hydrocarbons such as butylene which do not take part in the polymerization. If the butadiene is obtained by the heat decompn. of a hydrocarbon, other hydrocarbons forming by-products of the reaction need not be sepd., e. g., hexamethylene gives a mixt. of butadiene and butylene.

Artificial rubber. I. G. FARBENIND. A.-G. Fr. 658,359, July 19, 1928. Artificial rubber or masses resembling rubber are made by cautiously heating hydrocarbons such as butadiene or isoprene with substances having a "hydratropic" action, such as salts of sulfonic or carboxylic acids and their substitution products, amides and other substances having a like action, in aq. emulsion, with or without emulsion colloids such as albumin compds. Cf. C. A. 23, 4103.

Desulfurizing rubber. ARMAND ROGER. Fr. 659,480, Dec. 16, 1927. Waste vulcanized rubber, preferably freed from free S, is desulfurized by heating it with a divided adsorbent material such as active charcoal, SiO₂ gel or infusorial earth. A substance such as metallic Na capable of combining with the S or a vulcanization accelerator such as diphenylguanidine may be added to the adsorbent.

Isomerizing rubber. B. F. GOODRICH CO. Brit. 307,134, Dec. 20, 1927. A heat-plastic product suitable for use with various solvents in coating compns., etc., is obtained by heating rubber in the presence of a solvent such as C₆H₆ with PhOH and a strong non-oxidizing inorg. acid such as HCl or a sulfonic acid or sulfonyl chloride. The product may be directly used for coating metals by neutralizing the acid present (suitably by NH₃). Cf. C. A. 23, 4007.

Electrophoretic deposition of rubber. S. E. SHEPPARD and C. L. BEAL (to Anode Rubber Co., Ltd.). Brit. 307,585, Jan. 21, 1928. The heat produced by passage

of the current is removed by artificial cooling, enabling a high current d. to be employed. Numerous details of app. and procedure are described.

Retarding aging of rubber. A. M. CLIFFORD (to Goodyear Tire & Rubber Co.). Brit. 307,013, March 1, 1928. Substances such as phenylaminobenzyl alcs. and *p*- α - or - β -naphthylaminobenzyl alcs. (the manuf. of which is described) are used as "anti-agers."

Rubber solutions for use as adhesives. H. O. BRUHN. Brit. 306,864, Nov. 24, 1927. Solns. suitable for uniting woven materials comprise rubber dissolved in CCl_4 or similar C or hydrocarbon halide to which may be added a perfume and a substance for rendering the soln. more viscid such as an aq. soln. of sulfate of Al, Mg or Zn, $\text{Ca}(\text{NO}_3)_2$, Na Al chloride or the Na salt of propylnaphthalene sulfonic acid.

Rubber compositions. DUNLOP RUBBER CO., LTD., and R. C. DAVIES. Brit. 306,994, Dec. 1, 1927. Cellulose xanthate gel is added to latex or other rubber or similar dispersions to form compns. for molding, producing *leather-like products*, etc., with fillers, coloring substances, vulcanizing agents, etc.

Rubber compositions. IMPERIAL CHEMICAL INDUSTRIES, LTD., A. J. HAILWOOD, W. J. S. NAUNTON and A. SHEPHERDSON. Brit. 307,155, Jan. 11, 1928. Dispersion of fillers, dyes, accelerators, etc., in rubber is facilitated by coating finely divided particles of the material to be dispersed with substances such as oils, fatty acids, paraffin or other rubber softeners (which in some cases may combine with the material, as when stearic acid is used with magnesia). The material may be first formed into cakes and then ground.

Rubber compositions. AMERICAN GLUE CO. Fr. 659,368, Aug. 23, 1928. See U. S. 1,683,862 (C. A. 22, 4274). Fr. 659,369. See U. S. 1,683,863 (C. A. 22, 4274).

Freeing mercury from rubber compositions. BERNARD ORMONT (to Keystone Chemical & Mfg. Co.). U. S. 1,728,359, Sept. 17. In order to free chem. combined Hg from a matrix contg. rubber the material is heated sufficiently to melt the rubber, and further heated to a higher temp. completely to vaporize the combined Hg; the combined vapor is subjected to condensation to recover Hg and rubber as a condensate. The latter is heated to vaporize the Hg and rubber, and the product is washed with xylene to remove the rubber. An app. is described.

Rubber composition for making paving blocks, etc. EDMOND DRAULLETTE. U. S. 1,728,900, Sept. 24. Soft rubber waste 20-40, hard rubber waste 65-25 and fatty residues 15-35% are mixed and plasticized by heating to 120-150°. U. S. 1,728,991 relates to structural features of paving blocks formed in part of rubber compn.

Rubber-coating fabric-covered electrical conductors. EDGAR W. ENGLE (to Fansteel Products Co.). U. S. 1,729,160, Sept. 24. Fabric-covered conductors are dipped into a weak soln. of rubber, partially dried, then dipped into a strong soln. of rubber and the rubber is vulcanized on the conductor.

Coating metal or other surfaces with rubber. DUNLOP RUBBER CO., LTD., E. A. MURPHY and D. F. TWISS. Brit. 307,180, Feb. 8, 1928. The surface is first covered with gauze or mesh (stuck to the surface at intervals) and a soln. or aq. dispersion of rubber is then applied. Drying and vulcanizing may be concurrently effected.

Joining rubber and metal surfaces. S. S. K. JUNIOR (to Goodyear Tire & Rubber Co.). Brit. 307,056, March 2, 1928. Steel or other metal surfaces to which rubber is to be joined are preliminarily treated with salts of Co and Cu such as the oleates, stearates, palmitates, acetates or chlorides, or a rubber cement contg. Co or Cu salts may be used. Various details and modifications of procedure are described.

2,6-Dinitro-4-chlorophenyldialkyldithiocarbamates. SIDNEY M. CADWELL (to Naugatuck Chemical Co.). U. S. 1,726,648, Sept. 3. These compds. (*rubber vulcanization accelerators*) are made by treating a soln. of a metallic dialkyldithiocarbamate (e. g., Na dimethyldithiocarbamate) with 2,6-dinitro-1,4-dichlorobenzene, heating, cooling and crystg. and washing free from sol. chlorides.

Phenylmethylenebisdialkyldithiocarbamates. SIDNEY M. CADWELL (to Naugatuck Chemical Co.). U. S. 1,726,647, Sept. 3. A soln. of a dialkyldithiocarbamate salt (e. g., the dimethyl) is treated with benzal chloride, heating is continued until the benzal chloride has substantially disappeared, the reaction mixt. is cooled and the phenylmethylenebisdialkyldithiocarbamate is sepd. by crystn. Products of this character may be used as *rubber vulcanization accelerators*.

2,4-Dinitrophenyl dithiocarbamates. SIDNEY M. CADWELL (to Naugatuck Chemical Co.). U. S. 1,726,646, Sept. 3. Polynitrophenyl disubstituted dithiocarbamates are made by treating a soln. of a salt of a disubstituted dithiocarbamate with a soln.

of a dinitrochlorobenzene. These compds. are sol. in C_6H_6 , acetone and hot alc. and may be used as *accelerators in vulcanizing rubber*.

Vulcanizing rubber. CLAYTON O. NORTH and CHESTER W. CHRISTENSEN (to Rubber Service Laboratories Co.). U. S. 1,726,713, Sept. 3. See Fr. 652,817 (*C. A.* 23, 3600).

Vulcanizing rubber coverings of metal rolls by electric heating. C. MACINTOSH & Co., Ltd. and H. W. WOLTON. Brit. 307,628, March 10, 1928. A current of low voltage and high amperage may be passed through the metal spindle, or, with hollow rolls, a Cu coil may be inserted and an a. c. passed through it.

CHEMICAL ABSTRACTS

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No. 22

1—APPARATUS AND PLANT EQUIPMENT

W. L. BADGER

Refractory and corrosion-resistant materials used in Germany in the manufacture of chemical apparatus. B. K. KLIMOV. *Trans. State Inst. Applied Chem. (Moscow)* No. 12, 3-115(1929).—An app. exhibited at the 5th German exposition of chem. app. is described. Analyses are given of refractory silicates and tests are made of the action of various corroding reagents on elonite, steel, cast iron, silica and other specially prepd. apparatus materials. Krupp's refractory steels for pipes conveying liquids at high temp. in chem. manuf. analyzed thus: P 0.33, Ni 20.99, Cr 22.92, Si 1.2, S 0.075, Mn 1.2, C 0.22 and Fe 53.36%. These steels have a tearing resistance of 60-70 kg. per sq. mm., an elongation of 44-50%, do not rust even in sea water, resist all acids, except concd. HCl and H₂SO₄, are refractory up to 1000-1300°, have no magnetic properties, cannot be tempered and possess a good malleability in the cold state. B. N.

Corrosion-resisting steel for laboratory use. G. A. STOKES. *Analyst* 54, 538 (1929).—Dishes of stainless steel have been used to advantage for the detn. of total solids in milk and other foods. They are better than dishes of Al or Ni. W. T. H.

Air compressor for small laboratories. HARRY GILBERT AND WALTER GILBERT. *J. Optical Soc. Am.* 19, 148-9(1929). E. J. C.

Laboratory rectifying columns with non-siphoning bubbling-cap plates. JOHANNES H. BRUN. *Ind. Eng. Chem., Anal. Ed.* 1, 212-3(1929).—Details are given of app. for fractional distn. in which operating difficulties due to siphoning when adding cold liquid, or when shutting down the still, are eliminated. C. Z. ROSECRANS

New laboratory alkalimeter. LEO G. DAKE. *Chemist Analyst* 18, No. 4, 16 (1929).—A home-made app. is shown which can replace the more complicated Geissler or Knorr app. W. T. H.

Laboratory apparatus for the continuous circulation of liquids and vapors. REGINALD S. HUGHESDON, GEORGE J. ROBERTSON AND JOHN READ. *J. Soc. Chem. Ind.* 48, 263-4T(1929).—An app. is described which uses a gas lift for conducting liquids from the supply reservoir to the catalyst chamber. The liquid returns by gravity to be recirculated from the reservoir. M. C. ROGERS

Design and construction of an efficient laboratory air-pressure filter. H. L. KAUFFMAN AND J. B. MULL. *Chemist Analyst* 18, 20-21(1929).—Instead of using suction to promote filtration, a pressure filter can be used such as is described and depicted in this paper. W. T. H.

Automatic filter. LEO G. DAKE. *Chemist-Analyst* 18, No. 4, 18(1929).—A drawing shows how a simple automatic filter can be made with a separatory funnel. W. T. H.

Automatic filter. R. W. ASHWORTH. *Chemist-Analyst* 18, No. 4, 17(1929).—Place the soln. in an Erlenmeyer flask. In the neck of the flask place a stopper carrying a short tube extending just to the bottom of the stopper and a longer tube reaching nearly to the bottom of the flask. Arrange the tubes so that by inverting the flask over the filter, liquid will run out through the short tube until the filter is nearly full when the end of the longer tube will be sealed by the liquid in the funnel. Then as more liquid runs through the filter, more will drain out of the flask. W. T. H.

An economical mercury filter. H. HERMANN. *Z. physik. Chem. Unterricht* 41, 193(1928). The filter described combines large filtering surface and head-pressure with small capacity so that rapid filtration is obtained with small loss in filtration of small quantities. M. BEHR

A simple centrifugal filtration device for purification of small amounts of material by recrystallization. EYALD L. SKAU. *J. Phys. Chem.* 33, 951-4(1929).—Various forms of filters are described for sepg. liquids from solids at definite temps. These are easily made from glass, and porcelain disks. The method is particularly adapted to

recrystn. below 0° and where only small quantities of material are available.

Hardy recording spectrophotometer. ANON. *Oil and Fat Ind.* **6**, No. 9, 31-3 (1929).—This instrument is being developed by the General Elec. Co. of Schenectady, and consists of a color analyzer for use in measuring and matching colors without the use of the eye. It makes a definite and permanent record in the form of a curve, of every color and shade. The color is measured by reflected light. The spectrophotometer consists of an app. for breaking up the light reflected from a sample of color and measuring the intensity of each portion of the spectrum as compared with a standard. The record is made in the form of a continuous line on a chart; and the curve as drawn by the instrument is compared with the curve of the color which is being matched. The instrument is not yet ready for com. use.

E. SCHERUBEL

Simple viscometer tube. LEONARD ANNIS. *Chemist-Analyst* **18**, No. 4, 21 (1929).—A home-made tube is shown which will give good results when calibrated against an Engler viscometer.

W. T. H.

Counter weights for pycnometers. F. E. DANIELS. *Chemist-Analyst* **16**, No. 5, 18 (1929).—Details are given for making accurate counterpoises from brass piping.

W. T. H.

Improved reflux condenser. L. A. PAPPENHAGEN. *J. Chem. Education* **6**, 1618 (1929).—A hole is blown in the side of the condenser tube 2 cm. from the end connected to the still.

M. C. ROGERS

An improved "steaming out" device. JACOB CORNOG. *Chemist-Analyst* **18**, No. 5, 17 (1929).—A funnel is made by cutting off the bottom of a 250-cc. conical flask and inverting it. In the neck is placed a 2-hole stopper which fits a second flask. The stopper carries 2 tubes, through one of which steam passes when the water in the second flask is boiled. The other tube acts as a siphon for returning most of the condensate.

W. T. H.

An improved differential dilatometer. MAX HAAS. *Engineering* **128**, 424 (1929); cf. *C. A.* **23**, 4597.

E. J. C.

Apparatus records progress of gas reactions by pressure drop. W. T. ZIEGENHAIN. *Oil and Gas J.* **28**, No. 14, 133 (1929).—The app., devised at the Univ. of Calif., enables the progress of a slow gas reaction to be followed by the change in pressure. Oscillating and resonating circuits are used. There are 2 condensers in the resonance circuit, one a standard 1500μ variable condenser, C_1 , the other a small parallel-plate condenser, C_2 , one plate of which has rigid connection with a diaphragm that is pressed upon by the reacting gases. Change of pressure changes the distance between the plates and the capacity of this condenser is changed. The amt. of adjustment of the standard condenser necessary to restore resonance is a measure of the change of gas pressure on the diaphragm.

EMMA E. CRANDAL

Apparatus for the analysis of small samples of gas. H. R. AMBLER. *Analyst* **54**, 517-22 (1929).—An app. is described and pictured which is suitable for the analysis of 1 cc. of gas and gives results accurate to about 1%.

W. T. H.

Device for adjusting the leveling bulb on gas analyzing apparatus. A. M. McCOLLISTER. *Chemist-Analyst* **18**, No. 14, 22 (1929).—A simple contrivance is shown which has been designed for use with a Fisher Universal Gas Analyzer.

W. T. H.

An all-glass circulating pump for gases. ROBERT LIVINGSTON. *J. Phys. Chem.* **33**, 955 (1929).—A solenoid-operated glass pump for gases is described. Advantages of the particular type are said to be lowered frictional resistance and less sensitivity to the presence of satd. vapors.

C. Z. ROSECRANS

The calculations of air-drying plants. R. NITZSCHMANN. *Metallbörse* **19**, 1968-9, 2021-2 (1929).—By a series of equations, tables and graphs, calcs. for an air-drying plant are shown.

W. C. EBAUGH

A new rapid drying apparatus for the chemical industry. OTTO WOLFF. *Chem. Fabrik* **1929**, 181-2.—A drying chamber built of sheet iron and well insulated is described. The material to be dried is placed on special trays. The air for drying is forced through heating coils in the side of the chamber and then through the material to be dried.

M. C. ROGERS

Design and efficiency of air separators. I. P. ROSIN AND E. RAMMLER. *Zement* **18**, 804-9, 888-92, 942-6, 969-73 (1929).

H. F. K.

Simple hydrogen sulfide generator. OTIS A. CROSBY. *Chemist-Analyst* **18**, No. 4, 17 (1929).—FeS is placed in the neck of a flask which is provided with a retort-like opening on one side. By inverting the flask, acid in the bottom of the flask comes in contact with FeS and the H_2S escapes through the opening on the side of the flask.

By tilting the flask so that it lies on its side, the acid runs out of the neck and no more H_2S is liberated. W. T. H.

Determination of the quantity of sulfur dioxide absorbed by a liquid. WM. F. POND. *Chemist-Analyst* 18, No. 4, 10-11(1929).—An app. is described which takes a definite quantity of SO_2 and measures the residual gas after a solvent such as CCl_4 , C_6H_6 or $AcMe$ has been satd. W. T. H.

An easily constructed form of comparator for more accurate colorimetric determination of the hydrogen-ion concentrations of colored solutions. D. McCANDLISH AND G. HAGUES. *J. Inst. Brewing* 35, 66-8(1929).—In a box painted a dull black, light, from a "Fullolite" elec. bulb, of equal intensity is reflected by mirrors, at an angle of 45° , through the test solns. contg. indicators. The beams of light after passing through the colored solns. emerge at right angles, and are made parallel and adjacent by means of a pair of triangular glass prisms cemented together with Canada balsam over only half of their large face. Half of the rays of light going through each set of solns. is incident on the half of the prism surface with the air gap, which in 1 beam causes this half to be totally, internally reflected, and the other half emerges to form a composite beam constituting half the light passing through the 2 sets of colored solns., without being sep'd. by an intermediate band of darkness. The colors may be compared with the operator's eye on a level with the emerging beam of light, or may be viewed by means of an external mirror placed at an angle of 45° to the emerging beam. A diagram of the comparator is shown. PETER J. F. WEBER

Further developments on torsional apparatus for measuring plasticity. C. W. PARMELEE AND R. D. RUDD. *J. Am. Ceram. Soc.* 12, 552-5(1929).—Specimens were made by squeeze molding instead of hand forming. The loading device was changed to give continuous instead of intermittent loading. The specimens were designed so the ratio of max. stress in the outer fibers of the circular section to that of the square section was 3.8 to 1.0. C. H. KERR

Practical apparatus for the destructive distillation of coal and wood. W. H. CORNHETT. *J. Chem. Education* 6, 1761-2(1929).—In the lab. demonstration app the hard-glass test tube is replaced with a piece of $\frac{3}{4}$ " iron pipe capped at one end and fitted with a rubber tubing connection at the other end. M. C. ROGERS

Novelties of the vacuum technic for cathode oscillographs. MAX KNOLL. *Z. tech. Physik* 10, 294-8(1929).—Various improvements are discussed.

B. J. C. VAN DER HOEVEN
Device for maintaining a constant rate of flow of liquids. JOHN D. SULLIVAN. *Ind. Eng. Chem., Anal. Ed.* 1, 233(1929).—A siphon mounted on a float is used to give const. rate of flow. C. Z. ROSECRANS

Furnace bindings. A. R. TEGGE. *Iron and Steel Eng.* 6, 185-90(1929).—An outline of a few general principles regarding furnace bindings. Factors entering into binding problems are: foundation; support for masonry; support for auxiliaries such as furnace doors, door hoists, burners, etc.; temp. and temp. changes; stresses produced by masonry, and by temp. changes; mech. and chem. injury to masonry and binding; materials of construction. Materials of construction are: concrete (plain, reinforced and insulating), cast iron, cast steel and rolled steel (railroad rails, shapes, slabs, plates). A brief discussion is included. W. H. BOYNTON

The Isley furnace control. G. A. MERKT. *Iron and Steel Eng.* 6, 164-76(1929); cf. C. A. 22, 701. —The Isley furnace control constitutes a system of furnace construction rather than a type of furnace construction. The peculiar combination of old principles and the arrangement for controlling the speed and character of combustion effect a novel arrangement of reciprocating balanced draft regulation which insures an orderly process of heat production and exchange and its preservation and utilization. A discussion follows. W. H. BOYNTON

New explosion-proof motor for hazardous industries. E. P. PARTRIDGE. *Ind. Eng. Chem., News Ed.* 7, No. 19, 7(1929). E. J. C.

Preparation of photoelectric cells of thallium. Q. MAJORANA AND G. TODESCO. *Atti accad. Lincei* [6], 8, 9-14(1928).—Photoelectric cells have been constructed with Tl sulfides prepd. by heating mixts. of Tl and S under varying conditions and in different atms. Various media for the support of the sulfide were investigated, the best being, resp., Wood's metal, and an amalgam of equal parts of Cd, Zn, Sn and Hg, which hardens after some hrs. Details are given of the prepn. and performance of photoelectric cells made from these materials. B. C. A.

The cesium-magnesium photocell. V. ZWORYKIN AND E. D. WILSON. *J. Optical Soc. Am.* 19, 81-9(1929).—Photoelec. cells using Cs and Mg in combination offer advantages in manuf., since difficulties involved in handling Cs are overcome by the action

of the Mg coating in binding the Cs to the walls of the cell. Max. sensitivity for such cells lies at 4850 Å. U. Response-voltage, response-illumination and illumination-limit curves are given. Max. response of vacuum-type cells is 2 microamperes per lumen, and of the gas-filled cells 25 microamperes per lumen. Cells operated under conditions of extreme voltage and illumination have shown no decrease of sensitivity after 10,000 hrs. operation. The temp. coeff. of current response is practically zero.

C. Z. ROSECRANS

Damping liquids for aircraft instruments (KEULEGAN) 2.

Filter for oil. WM. H. McMACHEN and MARION F. McMACHEN. U. S. 1,730,581, Oct. 8. Structural features

Filter for artificial light. CHARLES HOLUB. U. S. 1,730,574, Oct. 8. A washed and hardened silk fabric is coated with a mixt. of gelatin and CuSO_4 and is suitable for eliminating glare.

Device for separating liquids from gases. THOMAS F. ROCHESTER (to Korcett Air Meter Corp.). U. S. 1,731,061, Oct. 8. A device is described suitable for sepg. oil from compressed air, etc

Apparatus for evaporation of liquids. EINAR MORTERUD. U. S. 1,731,146, Oct. 8. An app. is described having shallow spaced liquid troughs with a heater steam pipe extending vertically through openings in the troughs.

Distillation and fractionation system for various liquids. EUGENE H. LESLIE. U. S. 1,730,892, Oct. 8. An app. is described, including a fractionating column and reflux condenser, and various details of operation are given.

Rotating horizontal conical drum (with internal helical baffle and water jets) for separating mineral constituents of different densities. RENE E. TROTIER. U. S. 1,729,913, Oct. 1.

Apparatus for separating ore constituents or other materials of different specific gravities and physical character. HENRY M. CHANCE. U. S. 1,730,123 and U. S. 1,730,189, Oct. 1. Mech. features

Apparatus for effecting contact between solids and gases such as finely divided iron oxide and gas to be purified. EDWARD J. BRADY (to United Gas Improvement Co.). U. S. 1,731,223, Oct. 8.

Rotatable device for precipitating suspended particles from liquids. KARL T. R. LUNDGREN. U. S. 1,730,776, Oct. 8. Structural features

Getter for thermionic discharge devices. LEON McCULLOCH (to Westinghouse Elec. & Mfg. Co.). U. S. 1,729,888, Oct. 1. CaO is used with the product obtained by baking the oxalates of Ni and Mg.

Infra-red ray generator. THOMAS L. CROOM (to Wisley M. Barrett). U. S. 1,730,808, Oct. 8.

Photoelectric selenium cell containing iodine. RUSSELL HART. U. S. 1,730,505, Oct. 8. I is used to treat Se grids and serves to sensitize them to infra-red rays

Cathode for electron-emitting devices. FREDERICK S. ARMSTRONG (to National Union Radio Corp.). U. S. 1,730,897, Oct. 8. An elec. non conductive heating element such as quartz with embedded wire carries in direct contact an electron emitting coating held in place by wire mesh or similar material

Apparatus for sterilizing milk or other liquids by electric treatment. HARRY B. RUDD (to Electropure Corp.). U. S. 1,730,016, Oct. 1. Structural features.

Hydrometer of the syringe and internal-float type. LOUIS P. LAROSE. U. S. 1,730,221, Oct. 1. The float is provided with a thermometer and with a chain attached in a specified manner.

Inclined rotary apparatus for drying calcium formate or other materials. JOHN M. RUGH (to American Cyanamid Co.). U. S. 1,730,902, Oct. 8. Structural features

Tunnel for drying materials with hot air. MAURICE C. H. O. LEROCCQ. U. S. 1,729,675, Oct. 1. Structural features.

Gas burner. JOHN H. BEEBY (to E. I. Patenaude). U. S. 1,731,060, Oct. 8.

Gas burner. LEVI B. MILLER (to General Electric Co.). U. S. 1,729,677, Oct. 1.

Gas burner. EARL G. WALBRIDGE. U. S. 1,730,796, Oct. 8.

Oxygen supply tank and burner pipe construction, etc., for use in opening tap holes of open-hearth furnaces, etc. JAMES E. NEWTON (to Central Alloy Steel Corp.). U. S. 1,730,678, Oct. 8.

Immersion burner apparatus for direct heating of molten lead or other metals, sulfur, ores and acid solutions, etc. STANLEY C. SMITH. U. S. 1,730,440, Oct. 8. Various app. are described suitable for different purposes. In H_2SO_4 manuf., S and

air or O may be used in the burner for heating and coneg. the acid and the SO_2 produced by the burner may be subsequently used for the H_2SO_4 manuf. Zn may be converted into ZnO by an oxidizing flame. Ores may be heated with HCl, etc. Carbonating combustion gases may be utilized for reactions, such, e. g., as the production of BaCO_3 from a BaS soln. H evolved in the electrolytic manuf. of NaOH may be used with air for combustion to effect concn. of NaOH soln. without carbonation. Many details and other examples are given.

Electric combustion-control system for furnaces. MERRILL G. BENJAMIN (to Bailey Meter Co.). U. S. 1,729,700, Oct. 1. A system is described which is actuated by pressure differences in the furnace, etc.

Electric combustion-control system for boiler furnaces. FRANK S. BENNETT and LEONARD R. BIGGS (to Bailey Meter Co.). U. S. 1,729,701, Oct. 1. Supply of fuel is controlled in accord with rate of steam flow, and air supply is controlled in accord with the vapor pressure.

Heat-exchange apparatus. JAMES M. HARRISON. U. S. 1,730,139, Oct. 1. Structural features.

Heat-exchange apparatus suitable for use as a jet condenser or heater. JOHN P. RATHBUN (to Westinghouse Elec. & Mfg. Co.). U. S. 1,730,242, Oct. 1. Structural features.

Apparatus for treating strands of electric insulation with waterproofing material. ALFRED MARCHEV (to Western Electric Co.). U. S. 1,731,055, Oct. 8. Structural features.

Device for optical tests to differentiate between natural and cultivated pearls. CONSTANTIN CHILOWSKY and FRANCIS PERRIN. U. S. 1,730,190, Oct. 1. Structural and optical features.

Level vials filled with alcohol and with a kerosene bubble. ELBRIDGE F. BACON. U. S. 1,730,109, Oct. 1.

Thermostatic device for controlling electric circuits. PAUL F. SHIVERS (to Minneapolis Honeywell Regulator Co.). U. S. 1,730,831, Oct. 8. Structural features.

Thermostatic device for controlling electric appliances, etc. SANFORD TAYLOR (to Safgard Electric Appliance Co.). U. S. 1,731,068, Oct. 8. Structural features.

Thermostatic valve for controlling flow of liquids. JESSE E. ESHBAUGH (to A C Spark Plug Co.). U. S. 1,731,214, Oct. 8. Structural features.

2 GENERAL AND PHYSICAL CHEMISTRY

FREDERICK L. BROWNE

Fellowships and scholarships for advanced work in science and technology. CALLIE HULL AND CLARENCE J. WEST. Natl. Research Council, *Bull.* No. 72, 130 pp (1929). E. J. C.

Research scholarships and fellowships supported by industry. C. J. WEST AND CALLIE HULL. *Ind. Eng. Chem., News Ed.* 7, No. 19, 7 (1929). E. J. C.

Arthur S. Loevenhart. H. S. GASSER. *Science* 70, 317-21 (1929).—An obituary. E. J. C.

Willy Wien. M. V. LAUE AND E. RÜCHARDT. *Naturwissenschaften* 17, 675-81 (1929). Biography and portrait. B. J. C. VAN DER HOEVEN

C. Auer von Welsbach. JAN ŠTERBA BÖHM. *Chem. Listy* 23, 419-20 (1929).—A biographical sketch of W.'s chem. achievements. FRANK MARESH

Entropy and probability. W. S. KIMBALL. *J. Phys. Chem.* 33, 1558-78 (1929).—From the postulate that the probability of a particle is independent of its position in action and space, and from the Boltzman relation a direct derivation of the Maxwell distribution law is obtained by means of the Lagrangian method of conditional maxima. The same method may be used when the probabilities are weighted, in particular when quantum weights are used and the usual equations for the entropy of a gas are thus obtained very simply. The method does not involve concept of phase space or any detailed inquiry into the mechanics of collisions. F. R. B.

Corrections to be applied to the platinum scale of temperature. F. E. HOARE. *J. Sci. Instruments* 6, 99-102 (1929); cf. *C. A.* 23, 4382.—By using the equation $t - pt \approx d(t - 100)t$, where t and pt are, resp., the temp. on the centigrade and Pt scales, and $d = 1.50 \times 10^{-4}$, the corrections to be applied to the Pt scale between 0° and 1000° to convert into gas-scale temp. have been tabulated. B. C. A.

Thermoelectric temperature scales. W. F. ROESER. *Bur. Standards J. Research*

3, 343-58(1929).—The differences between 4 thermoelec. temp. scales, based upon (1) Sb, Ag and Au; (2) Zn, Sb, Ag and Au; (3) Zn, Al and Cu; and (4) Zn, Sb and Cu as calibration points, have been detd. The max differences, in the temp. range 660° and to 1063° were: between (1) and (2), 0.1°; between (1) and (3), 0.2°; between (1) and (4), 0.3°. The f. p. of the Cu-Ag eutectic alloy, 71.9% Ag and 28.1% Cu, was found to be 779.4° C \pm 0.1°, on the 1927 Intern. Temp. Scale. The difference between the f. ps. of Au and Cu was found to be 20.0° \pm 0.1°. The methods used at the Bur. of Standards in realizing the Intern. Temp. Scale in the range 660° to 1063° are described in detail. F. D. ROSSINI

Variation of temperature along an incandescent thin tungsten wire. A. DENISOV. *Z. tech. Physik* 10, 168-71(1929).—A photographic method was used for the detn. of influence of thickness on the temp. of a filament. The blackening of the photographic plate was related to temp. by the Langmuir equation for current $I' = I/d^{3/2}$ as a function of temp. (*Gen. Elec. Review* 30, No. 6(1927)) the thickness d being known. A curve found relating blackening to temp. is reproduced. B. J. C. v. d. H.

The correction of thermoelements for temperature variation of the cold junction. U. RERZOW. *Z. tech. Physik* 10, 164-8(1929).—A review. The cold junction temp. correction for a cubic, quadratic and linear relation between c. m. f. and temp. are discussed. B. J. C. VAN DER HOEVEN

Platinizing glass and other substances. G. F. TAYLOR. *J. Optical Soc. Am.* 18, 138-42(1929).—Improved methods are described of prepg. and applying a platinizing soln. of platonic chloride, oil of rosemary, and oil of lavender, so as to obtain either a surface which can be soldered or a fine, flawless mirror. Various properties of the films and applications of the method are described, and other materials which can be similarly treated are mentioned. B. C. A.

The use of a quartz lamp in qualitative analysis. VÁCLAV KUBELKA. *Chem. Listy* 23, 312-8(1929).—Minerals exhibit a characteristic glow under ultra-violet rays: limestone and dolomite glow ruby-violet, magnesite a pale violet, fluorspar blue, sodalite orange, spinel violet, beryl blue, calcite brown and zircon yellow. Few of the natural gems show a characteristic glow. Opal alone shows a typical milky opalescence. Sapphire, lapis lazuli, chrysoprase, tourmaline, emerald, ruby, onyx, amethyst and topaz remain colorless under the lamp or show an untypical glow under the most careful examn. This does not apply to differences in fluorescence observed in a luminescent microscope. FRANK MARESH

Low-humidity drying. M. G. W. TOMLINSON. *Heat, Piping and Air Conditioning* 1, No. 5, 394-5(1929).—New psychrometric charts have been calcd. and vapor pressures for satd. air-water vapor mixts. are given. E. I. S.

The law of definite proportions. SIDNEY J. FRENCH. *J. Chem. Education* 6, 1542-3(1929).—A stimulating expt. for students is described, yielding results within 3% of theory. About one g. of S is placed in the bottom of a hard-glass test tube, and exactly 2 g. of Cu turnings wadded into a loose plug shoved down the tube, but not to the bottom. The S is heated and Cu₂S forms with glowing; the tube and contents are heated until the excess S volatilizes and condenses above the Cu. Residual Cu₂S is then shaken out and weighed. W. C. EBAUGH

A simple method for the simultaneous determination of the components of hydrogen peroxide. (A contribution to demonstrate the law of multiple proportions.) WALFRIED SEEGER. *Z. physik. Chem. Unterricht* 41, 182-4(1928).—By titrating H₂O₂ in a closed flask with standard KMnO₄ both the H₂ and O₂ content are detd.; the H₂ from the fact that 1 cc. 0.1 N KMnO₄ \approx 0.1008 mg. H₂ and the O₂ by collecting it, measuring its vol., and converting this to weight. M. HERBER

Practical atomic weights. G. BRUHNS. *Z. angew. Chem.* 42, 645-6(1929).—The desirability of using extremely accurate at. wts., and the need for a yearly revision are questioned. ALBERT L. HENNE

The electronic theory of valency. VII. The etch figures of sylvine. T. M. LOWRY AND M. A. VERNON. *Trans. Faraday Soc.* 25, 286-91(1929); cf. C. A. 22, 4045.—Natural and synthetic crystals of KCl were etched with solns. of pure KCl and with solns. contg. traces of optically active substances. Photomicrographs of the figures are published. The expts. indicate that crystals of sylvine contain no structural element that leads to the development of unsymmetrical etch figures, and that the occurrence of these is purely fortuitous. The presence of optically active impurities failed to produce unsymmetrical etch figures. The higher symmetry established by x-ray analysis cannot be challenged on the basis of data from etch figures. No evidence of the existence of mols. in KCl crystals was obtained. However, crystals

of ice and quartz, and the anions of oxygenated acids, such as calcite and barytes, should not be regarded as mere aggregates of oxide ions \bar{O} with cations such as H^+ , C^{+++} , N^{++++} and S^{++++} .

The formation of ice is regarded as a process of polymerization. A network of single bonds between quadrivalent O and bivalent H is assumed. The O atoms in the CO_3 , NO_3 , SO_4 and SiO_4 ions are assumed to be linked to the central atoms by single bonds, and to carry single neg. charges. A network of single bonds is postulated in quartz.

MERRILL W. SEYMOUR

Chemical forces, atomic structure, refractometric data. KASIMIR FAJANS. *Oesterr. Chem.-Ztg.* 32, 125(1929).—A lecture on modern theories of matter. W. C. E.

Isotopes of oxygen. RAYMOND T. BIRGE. *Nature* 124, 13-4(1929).—The equation given by Dieke and Babcock for the upper level of the atm. O_2 band (C. A. 21, 3828) is incorrect because of an arithmetical error of 2 cm.^{-1} in the location of the origin of the $O-O$ band. The corrected equation is $E_n = 13,120.97 + 1418.69n - 13.925n^2 - 0.02n^3$ ($n = 0, 1, 2, 3$). The new consts. greatly reduce the discrepancies between theory and observation in the isotopic sepsns. of mols. formed from O^{16} , O^{17} and O^{18} . On the basis of the relative abundance of the isotopes (cf. C. A. 23, 4130). Aston's detns. of at. wts. should not be more than 1 in 10,000 greater than the chem. values.

W. WEST

Principle of Pauli and the periodic system of the elements. RUDOLF ORTVAY. *Magyar Chem. Folyóirat* 34, 171-7(1928).—The principle of Pauli is described (C. A. 19, 2450) and is applied to the explanation of period lengths of the periodic system.

S. S. DE FINÁLY

The electronic configuration of the elements. C. G. BEDREAG. *Bull. Fac. Stiinte Cernauli* 2, 44-64(1928); *Physik. Ber.* 9, 2020.—A table of the elements is given. The arrangement is based on previously published work (cf. C. A. 22, 2298).

ALBERT L. HENNE

The quantum theory of a vibrating continuum. FRIEDRICH MÖGLICH. *Ann. Physik* [5], 2, 676-706(1929); cf. C. A. 22, 3828.—The discovery of a proper canonical transformation makes it possible to prove the existence of action and angle variables for a continuum. Quantizing these variables by matrix methods gives the correct result that the total energy is the sum of the proper energies of the free oscillations. The Einstein equation for the decrement is derived.

F. R. BICHOWSKY

Further experiments on para-hydrogen. K. F. BONHOEFFER AND P. HARTECK. *Naturwissenschaften* 17, 321-2(1929).—Vapor pressure and m. p. of pure para- H_2 prepd. by adsorption of H_2 on C at liquid H_2 temp. were detd. If it is assumed that 13.95° and 20.39° abs. are the m. p. and the b. p. of normal H_2 , for para- H_2 , $p_{20.39} = 760\text{ mm.}$, $p_{20.39} = 787 \pm 1\text{ m.m.}$ For normal H_2 , $p_{13.95} = 53.9\text{ mm.}$ (triple point) and for para H_2 , $p_{13.95} = 57.0\text{ mm.}$ (liquid) with $p_{13.95} = 53.0 \pm 0.1\text{ mm.}$ (triple point). The difference is mainly due to the 0.65% lower heat of vaporization of para- H_2 . In the α system of the multiline spectrum of normal H_2 , as compared with para- H_2 , a complete shift of intensity relations was found.

B. J. C. VAN DER HOEVEN

Parachor and chemical constitution. XII. Fused metals and salts. SAMUEL SUGDEN AND HENRY WILKINS. *J. Chem. Soc.* 1929, 1291-8; cf. C. A. 23, 2423.—Previous work covered substances which in the liquid state are nonconductors of electricity; the parachors of conducting liquids will now be considered. These values exhibit a no. of anomalies and may be either greater or less than the predicted values. The parachor of a salt involves the const. for a polar bond, for which the value -1.6 units was previously suggested. From this value, the parachors for 10 org. salts are calcd.; the first 6 are within the exptl. error: $PhNHMe.HCl$, $PhNHEt.HCl$, $Me_2NH.HNO_3$, $Et_2NH.HNO_3$, $PhNMe_2.H_2SO_4$, Pr_4N picrate, $EtNH_2.HNO_3$, $PhNMe_2.HBr$, $(iso-Am)_2NHSCN$ and $(iso-Am)_2NI$. There appears to be no connection between the Ramsay-Shields coeff. ($k = d\gamma(M/D)^{1/2}/dT$) and the occurrence of parachor anomalies; both normal and abnormal salts show a wide variation in the value of this coeff. $PhNHMe.HCl$ and $PhNHEt.HCl$ are evidently largely ionized in the liquid state and have conductivities comparable with those of the fused picrates of quaternary bases. Parachors are given for salts of Tl , $SnCl_2$, $PbCl_2$, Hg , Al , Sn , Pb and Sb ; these frequently exhibit large positive anomalies. From the data of Jaeger the following approx. at. parachors are derived: Li , 50; Na , 80; K , 110; Rb , 130; Cs , 150; the bromides and iodides usually give the highest values for the metallic parachors and the sulfates, nitrates, phosphates and particularly the fluorides give much lower figures. $PhNHMe.HCl$, m. $122.5-3^\circ$ (all m. ps. cor.), $d_4^{20} 1.0808 - 0.000527(t - 100)$, γ 44.53,

43.50, 42.68, 41.29 at 130°, 140.5°, 150.5° and 160°, resp., parachor 348.5. PhNHEt . HCl , m . 178.5°, d_4^{25} 1.0492 — 0.000493 ($t - 100$), γ 35.82, 35.41, 34.50 at 173.5°, 180.5° and 188.5°, resp., parachor 381.9. Pr_2N picrate, m . 117.5–8°, d_4^{25} 1.159 — 0.00086 ($t - 100$), γ 41.80, 41.30, 40.72, 40.03 at 129°, 135°, 143.5° and 152.5°, resp., parachor 931.8. $\text{EtNH}_2 \cdot \text{HNO}_3$, m . 8°, d_4^{25} 1.225 — 0.000801, γ 48.8, 47.6, 46.2, 45.4, 44.9 at 11°, 30°, 56.5°, 82.5° and 97°, resp., parachor 239.2. $\text{Me}_2\text{NH} \cdot \text{HBr}$, m . 84.5–5.5°, d_4^{25} 1.398–0.00864, γ 50.40, 49.55, 49.00, 48.60, 48.07 at 97°, 112°, 118.5°, 129° and 136.5°, resp., parachor 412.8. $\text{PhNMe}_2 \cdot \text{H}_2\text{SO}_4$, m . 88–9°, d_4^{25} 1.283 — 0.00074 ($t - 100$), γ 55.2, 54.9, 54.0, 53.7 at 105.5°, 114.5°, 126° and 133°, resp., parachor 469.5. **XIII. Some compounds of titanium and tin.** **FREDERICK B. GARNER AND SAMUEL SUGDEN.** *Ibid* 1298–302.—This study was made chiefly to elucidate the structure of the additive compd. of SnCl_4 and POCl_3 (Casselmann, *Ann.* **91**, 242(1854); **98**, 217(1856)). SnCl_4 , b_{768} 114° (all b. ps. are cor.), d_4^{25} 2.284 — 0.002391, γ 31.15, 29.01, 27.39, 26.63, 25.02 at 12°, 29.5°, 40°, 51° and 58.5°, resp., parachor 272.8; SnBr_4 , b_{768} 204°, m . 29.5°, d_4^{25} 3.427 — 0.002841, γ 37.76, 35.32, 33.91, 32.09 at 37°, 51.5°, 64° and 75.5°, resp., parachor 325.8; SnI_4 , b_{768} 180.5–1.5°, d_4^{25} 1.219 — 0.001131, γ 26.22, 24.05, 22.08, 22.08, 20.41 at 13.5°, 34.5°, 46°, 55.5° and 77.5°, resp., parachor 441.1; from these values, the at. parachor is detd. as 56.7. The compd. $\text{SnCl}_4 \cdot 2\text{POCl}_3$, b_{106} 70°, m . 54.5°, d_4^{25} 2.090 — 0.002931, γ 29.88, 29.12, 28.27, 27.70, 27.27, 25.87 at 57.5°, 64°, 67.5°, 71.5°, 74° and 81.5°, resp., parachor 691.6. This probably has the structure $\text{Cl}_4\text{Sn}(\text{O} \cdot \text{PCl}_2)_2$ but the parachor shows that it is largely dissociated into its generators in the liquid state. TiCl_4 , b_{768} 136°, d_4^{25} 1.767 — 0.001621, γ 34.03, 32.16, 30.78, 29.08, 26.65 at 13°, 27.5°, 39.5°, 52° and 75°, resp., parachor 262.5; at. parachor for Ti, 45.3.

C. J. WEST

Artificial preparation of diamonds. **I. SESTA.** *Phil. Mag* [7], **7**, 488–93(1929).—S. presents the evidence from his own work and the work of La Rosa (cf. *C. A.* **3**, 1368; **4**, 1429) that diamonds have been produced in the lab. Exptl. evidence is given to show that it is impossible to form spinels as claimed by others and that small diamonds must have been formed.

L. H. REYERSON

The molecular condition of molten sulfur. **B. LANGE AND W. COUSINS.** *Z. physik. Chem.*, Abt. A, **143**, 135–8(1929).—The mol. condition of a S melt was studied at various temps. by means of the intensity of Tyndall light (*C. A.* **22**, 2503–4). Red light, 650m μ , was used; the S was kept in an electrically heated Cu block with glass container. The depolarization values, Δ (intensity ratios of the two vibration components), ran from 0.472 to 0.217 between 120° and 265°, indicating a decrease in mol. size. This effect is in agreement with the disson theory as proposed by Beckmann (*C. A.* **13**, 2787) and by Aten (*C. A.* **9**, 6). From Δ and the compressibility of the melt the mol. size can be calcd. (*C. A.* **22**, 1091, 1899). At low temps. S_8 predominates, at higher temps. S_4 and S_2 ; no evidence of colloidal complexes at high temp. was found. Difference in results on soly. of S from earlier observers is probably due to difference in rate of cooling of the melt.

B. J. C. VAN DER HOEVEN

A relation between the influence of elements on the polymorphism of iron and their position in the periodic system. **FRANZ WEVER.** *Naturwissenschaften* **17**, 304–9(1929); cf. *C. A.* **23**, 3646.—In their influence on the polymorphism of Fe, in particular on the shape of the field of γ -iron (cubical, face-centered) admixed elements can be divided into 2 groups. One group enlarges the temp. range of γ -stability and in case of high soly. stretches the γ -field to the limits of the crvst. state (Ni, Mn and elements of the eighth group: Co, Ru, Rh, Pd, Os, Ir, Pt) or for less soly. is bounded by a heterogeneous system (C, N, Cu, Zn, Au). The second group gives either a very small closed γ -field and retrograde equil. line (Be, Al, Si, P, Ti, V, Cr, Ge, As, Sb, Mo, Sn, Sb, Ta, W) or a narrower temp. range of γ -iron bounded by a heterogeneous system (B, S, Zr, Ce). Many of the first group of elements are isomorphous with γ -iron; those of the second group are isomorphous with α -iron. A more general explanation of the problem is, however, contained in an old theory of Osmonds (*Compt. rend.* **110**, 346(1890)): Elements of small at. vol. will tend to produce in iron the mol. form which has the smallest at. vol. (i. e., γ -iron). This theory holds for all admixts. except the very smallest ones, B and Be. Several details are discussed.

B. J. C. VAN DER HOEVEN

Germanium. **IV. The solubility of germanium dioxide in acids and alkalis.** **WM. PUGH.** *J. Chem. Soc.* **1929**, 1537–41.—The soly. of GeO_2 in HCl decreases with increase in the HCl concn., being min. at 5.3 *N* HCl , and then increases rapidly with

further increase in the acid concn. During the decrease $\text{Ge}(\text{OH})_4$ ionizes principally as an acid (thus its soly. is repressed by the addn. of HCl), while beyond the min. it ionizes principally as a base (forming GeCl_4 with HCl). In H_2SO_4 soln. the soly. of GeO_2 decreases constantly with increase in the acid concn., indicating that $\text{Ge}(\text{SO}_4)_2$ does not exist, at least in aq. soln. In NaOH soln. the soly. of GeO_2 increases; probably this is due to the peptizing action of NaOH and to the existence of salts of condensed germanic acids.

J. BALOZIAN

The dimensions of diatomic molecules. F. K. SUIRKIN. *Z. physik. Chem.*, Abt. B, 5, 156-9 (1929).—Diatomic homopolar mols. are considered as rigid linear quadrupoles with charges of the same sign at the ends and opposite sign at the middle. The calcd.

moment of the quadrupole is $m = 0.77 \times 10^{-28} T_{kr} V_{kr}^{1/6}$, where T_{kr} and V_{kr} are, resp.,

the crit. temp. and vol.; and the length of the dipole is $r = 5.68 \times 10^{-10} T_{kr}^{1/6} V_{kr}^{1/12}$. The values of r thus calcd. agree well with spectroscopic values for typical diatomic homopolar mols., but not for the halogen hydrides, in accordance with the dipole character of the latter.

W. WEST

Volume of metal alkyls. W. HERZ. *Z. anorg. allgem. Chem.* 182, 173-6 (1929).—The mol. vol. at zero abs. is detd. by using the formula $\psi_0 = (n_0^2 - 1)/(n_0^2 + 2)$, in which n_0 is the index of refraction at zero abs. This is calcd. by use of the equation $n_0 = \sqrt{(M + 2d_0R)/(M - d_0R)}$, in which R is the mol. refraction, M is the mol. wt. of the metal alkyl and d_0 its density at 0° abs. For calcn. of d_0 the equation $d_0 = d(0.77 + 0.64 T/T_0)$ is used, in which d is the observed density at temp. T and T_0 is the abs. b. p. The results are tabulated for di-, tri- and tetra-alkyls of Zn, Cd, Hg, Ge, Pb and Sn, ψ_0 ranging from 0.300 to 0.422. In each series of alkyl compds. of a metal ψ_0 decreases with increasing mol. wt. of the org. groups. Thus for dipropyl Zn, $\psi_0 = 0.350$, for diisobutyl Zn, $\psi_0 = 0.331$ and for diisoamyl Zn, $\psi_0 = 0.321$. For the same alkyls of Cd, $\psi_0 = 0.347, 0.341$ and 0.335 . On the other hand with increasing at. wt. of the metal, ψ_0 increases. Thus in the case of the tetraethyl compds., $\psi_0 = 0.331$ for Sn and 0.358 for Pb. Hg alkyls are exceptions, ψ_0 for its compds. being less than for the compds. of Cd. Decrease of ψ_0 with increase of mol. wt. of the org. groups also holds when the compds. do not contain the same org. radicals but are mixed compds. Isomeric compds. show only slight differences in ψ_0 as in the case of tetrapropyl lead and tetraisopropyl lead. ψ_0 is 0.338 for the first and 0.348 for the second.

H. STOERTZ

The energy functions of the hydrogen molecules. O. W. RICHARDSON and P. M. DAVIDSON. *Proc. Roy. Soc. (London)* A125, 23-50 (1929); cf. C. A. 21, 705; 23, 2096, 2883, 3163. —A comparison of vibrational and rotational detns. of the terms in the expansion of the force function near the equil. position shows that the vibrational method permits far greater accuracy. By employing this method, data for excited H_2 mols. 2^1S , 2^3S , 3^1P and unexcited HCl mols. are compiled, the potential energy functions $U \xi$ of 2^1S , 2^3S , 3^1P , 3^1B and H_2^+ are mathematically derived, and the total energy of the H_2 mols., the manner in which they dissoc., and the mean kinetic energy together with the range of validity of the expansions are discussed. Data for 30 states of H_2 are given in a table. A general comparison of the states of H_2 and of the H_2 mol. ion is made. Equations for the mean kinetic energy of a system of particles in motion under their mutual forces are developed.

H. W. WALKER

Energy relations in molecules. G. BECK. *Z. anorg. allgem. Chem.* 182, 332-42 (1929).—A continuation and extension of B.'s theory relating thermochem. properties with mol. structure (cf. C. A. 21, 850, 2581; 22, 4043). Complete ionization of the alkali halides, the conditions necessary for formation of an ion lattice in salts, and hetero- and homeo-polar linkages are considered from the point of view of the theory.

S. LENHER

The orientation of molecules on solid surfaces and the extent of the orienting forces. D. TALMUD. *Z. physik. Chem.*, Abt. A, 142, 233-6 (1929).—Hydrophylic powders, such as CaCO_3 and BaSO_4 , on which a trace of oleic acid is adsorbed, ext. water-insol. org. liquids from their mixts. with water. A drop of mineral acid or an excess of oleic acid causes the org. liquid to sep. J. Traube has observed the opposite; viz., that PbS powder (a hydrophobe) retains benzene, which is sepd. by the addn. of a drop of oleic acid. Both observations agree with P. Reh binder's flotation theory, with the Langmuir-Harkins view of the orientation of adsorbed mols., and with the rule of K. Fajans regarding the adsorption of ions by crystal lattices. 0.5 g. CaCO_3 + 0.001 cc. oleic acid retained 9.48 cc. amyl alc., corresponding to a layer of 100μ thickness. 0.5 g. CaCO_3 + 0.025 cc. oleic acid retained 2.50 cc. amyl alc., corresponding to a layer of 30μ thickness.

MERRILL W. SEYMOUR

Organic dipole molecules with singly and doubly bound oxygen. K. L. WOLF. *Z. physik. Chem.*, Abt. B, 3, 128-38(1929).—Substituents may have different moments, depending upon whether they form part of an aliphatic or an aromatic compd. The OH group appears to have a greater moment in phenol than in aliphatic alcs. and, on the basis of the dipole moment of phenol, is assigned the value 1.73×10^{-18} in benzene derivs. By assuming a normal angle of 110° between the two valences of singly bound O atoms in org. compds., anomalies in the dipole moments of disubstituted benzene derivs. are removed. Also, it becomes possible to give the moments of the OH and OCH_3 groups a pos. sign in agreement with the chem. characteristics of these groups. The O and C atoms in the carbonyl group are assumed to be joined as in CO mols., with an octet and 2 valence electrons forming a shell of ten electrons surrounding both atoms. This group is joined to a carbon chain by contributing both of its outer electrons to the octets of the neighboring C atoms. The dipole moment of the CO group is thereby altered. This moment is not to be ascribed to doubly bound O, but to the CO "pseudo atom" as a whole. The two valences of the CO group are assumed to be at an angle of 110° . If the O, as previously assumed, is doubly bound to the C atom, and detrs. the moment of the group, the introduction of this group into a ring in which strain exists should have only a secondary influence on the moment of the group. If W.'s assumption is correct, ring strain should greatly alter the moment of the CO group. W.'s views are substantiated by detrs. of the dipole moments of cyclohexanone and menthone, contg. CO as part of a 6-membered ring. The moments are 2.75×10^{-18} and 2.77×10^{-18} , resp., as in aliphatic ketones. The ultra-violet absorption spectra of these ring compds. shows the absorption band for the CO to have the position expected for aliphatic ketones with branched chains. Assocn. and shifting of the absorption bands by solvents extend the analogy. MERRILL W. SEYMOUR.

The stability of spatial atom configurations. PAUL GOLDINGER. *Naturwissenschaften* 17, 387(1929); cf. *Dissertation Zurich* 1929. If the Pauling ion radii are used, it is possible to explain crystallographic laws by closest packing of spheres, taking according to Wassatjerna for the central atom the pos. for the surrounding atoms the neg. radius. The same procedure gives the structure of many gaseous or dissolved mols. The pyramidal structure of solid SiF_4 and its dipole moment can be predicted as compared with liquid SnCl_4 ; the flat structure of BF_3 and BCl_3 follows as well as that of various Werner complexes ($(\text{NH}_3)_6\text{PtCl}_6$). Other explanations are discussed. From a table of R values for halogens (F 0.07 A., Cl 0.26, Br 0.39, I 0.50) the possibility of existence of, and the configuration of their oxy acids is shown. A generalization of stereochemistry. *Ibid.* 388.—Closest packing of spheres accounts for the symmetry of most org. compds. The small radius (0.2 A., F.) of C allows only a tetrahedral configuration of the surrounding groups. Larger atoms as S (0.3), Se (0.4), Te (0.8), will tend to give pyramidal structure. B. J. C. VAN DER HOEVEN.

The system of chemical compounds from the viewpoint of atom research; several problems of experimental chemistry. H. G. GRIMM. *Naturwissenschaften* 17, 535-40, 557-64(1929).—A novel system of classification of chem. compds. is obtained by considering for both the component atoms of compds. of the type M_xN_y , charge, size and no. of external electrons of the ion (cf. *Festschrift 60 Geburtstag Arnold Sommerfelds* 173; Leipzig, 1928). The system is illustrated in various tables representing the six dimensional extension and is exhaustively discussed also for org. compds. Several problems are indicated, and abundant references given. B. J. C. VAN DER HOEVEN.

Chemical properties of metals. CECIL H. DESCH. *Metal Ind.* (London) 1928, 470-3, 495-9(1928); *J. Inst. Metals* No. 465, 20 pp. Discussion of the types of electronic unions between atoms; the types of bonds in crystals, i. e., ionic, mol., etc.; the relation of residual valence to the lattice structure; etch figures and their distribution; solid solns. and intermetallic compds.; open-packed structures, e. g., graphite; diffusion and the importance of loosening of texture. R. L. HERSHEY.

Method for showing the metallic luster of the alkali metals. W. CONRAD FERNELIUS AND IMAN SCHURMAN. *J. Chem. Education* 6, 1765-6(1929).—An app. is described for filtering alkali metals, etc., through a small orifice in an evacuated system to remove oxide or other solid impurities. W. C. FERNELIUS.

Kinetics of the phenomena of passivity. W. J. MILLER. *Z. Elektrochem.* 35, 656-70(1929); cf. *C. A.* 23, 3393. Anodic passivity of Fe was known to be associated with a time phenomenon. An equation $t_p = B(L_0/F_0)^m$ relates the time t_p required before rapid decrease in current strength occurs, with $(L_0/F_0)_0$, the current density at the beginning. B , the sp. time for passivity, is the time required for the material to become passive at a current density of 1. The validity of this relation was demonstrated for Fe, Ni, Cr, Zn, Cu and Pb with acid solns. Variations of B and m with the

concn. and temp. of the H_2SO_4 soln. measure the influence of concn. and temp. on the sp. time required for metal to become passive. For Fe the value of B increases with the H_2SO_4 concn., reaches a max. and then decreases. B varies as the soly. of FeSO_4 in H_2SO_4 . With const. acid concn. B increases logarithmically with the temp. Two types of passivity were noted from studies of current-time curves. For metals that are normal chemically when passive the current strength-voltage curve is continuous and decreases slowly until a low const. current value is reached. For metals as Fe whose passivity is associated with changes in anodic reactions, the curve at low voltages breaks rapidly and runs near and parallel to the abscissa. Time is related to the current density in passivity studies by $t - t_0 = B[(1/i^2) - (1/i_0^2)]$. Oscillograph curves were made for Cu, Pb, Al and Zn anodes to det. relation of time to current strength. The relation as given was valid for all cases studied as well as for Fe and Cr anodes using low c. ds. In the latter cases for conditions of low c. ds. passivity is due to a film. Chem. passivity did not occur. From the current-time curves or the voltage-time curves it can be definitely detd. whether passivity is of a chem. nature or depends upon the formation of a film upon the electrode. The appearance of chem. passivity depends upon attaining a definite effective current density. C. H. LORIG

Internal field of polarization. R. DE MALLEMANN. *Compt. rend.* 187, 720-2 (1928).—The method of C. A. 23, 746, is applied to obtain a new expression for the refractive index. This equation gives values between the theoretical values of Laplace and of Lorentz and close to the empirical values of Gladstone. F. R. BICHOWSKY

A peculiar regularity of the molecular polarization of some pure dipole substances. P. GROSS. *Physik Z.* 30, 504 6(1929).—Tabulation is made of dielec. const. E , density d , mol. wt. M , mol. polarization $P_m = (E - 1)/(E + 2)(M/d)$, mol. refraction $P_E = (n^2 - 1)(n^2 + 2)(M/d)$ and dipole moment $\mu \times 10^{18}$ (all at 20°) for 32 org. compds. having various halogen substitutions. P_m is approx. the same for many of the groups with variable halogen, which is explained by the compensatory effect of increasing μ (from I to F) and decreasing P_E (electron polarization) in the same direction. For PhI, PhBr, PhCl and PhF $P_m = 60.7, 62.7, 62.0$ and 61.4 , resp. B. J. C. v. D. H.

An expression for optical rotation corresponding to that for molecular refraction. K. L. WOLF AND H. VOLKMANN. *Z. physik. Chem., Abt. B*, 3, 139-48(1929).—By applying the correction of Gans to Born's formula for optical rotation, it is found that the quantity $K = [\alpha]/(n^2 + 2)$ should be independent of the solvent, concn. and temp., excepting where new forces come into play when the substance is dissolved. This quantity remains const. for some measurements of Wetterfors on the rotation of bromocamphor in acetone, whereas the quantity $[\alpha]/(n^2 + 2)^2$, deduced from the uncorrected expression, is a variable. The Born-Gans theory is supported by new measurements on the rotation, n , and d of solns. of limonene in different solvents and in various concns. K does not depend directly upon n of the solvent, but increases in solvents with large dipole moments. The dipole moment of limonene is $< 0.5 \times 10^{-18}$. Menthone (dipole moment $2.77 \pm 0.04 \times 10^{-18}$) and carvone (dipole moment approx. same as of menthone) showed much greater deviations in the values of K in several solvents. The ultra-violet absorption bands of menthone, carvone and aliphatic ketones are displaced toward the longer wave lengths in acetone soln., the displacement slowly increasing with diln. of the soln. Under these conditions, K cannot be independent of concn. The first ultra violet absorption band of menthone is displaced 17 Å. U. in the pure substance, and 50 Å. U. in 0.14 N soln. as compared with the 0.13 N soln. in hexane. The large variations in K in benzene, etc., are probably due to mol. compds. Thus, variations in K depend upon the polarizability and the dipole moment of the optically active substance and the solvent. M. W. S.

Measurement of magnetic rotatory power of gases and vapors. R. DE MALLEMANN AND P. GABIANO. *Compt. rend.* 189, 281 2(1929). With a solenoid of six coils in series, each 1 m. long contg. together 21,276 turns of wire 3 mm. in diam., capable of carrying 30 amp., and a jacketed brass tube 35 mm. in diam. closed at the ends with carefully annealed glass almost free of birefringence, the magnetic rotatory powers of CO_2 , SO_2 , CS_2 , C_2H_2 , and $\text{C}_2\text{H}_2\text{Cl}$ were measured. The light was furnished by a Hg-vapor lamp. With temps. 26.5 - 280° , pressures 377-2211 mm., current of 24-27 amp., magnetic potential difference 641,330 c. g. s. units ($721,500$ for I) $A_{578}^{0.760\text{mm}} \times 10^6$ for $\text{CO}_2 = 9.4$; $\text{SO}_2 = 30.5$; $\text{CS}_2 = 84.5$; $\text{C}_2\text{H}_2 = 31.0$; $\text{C}_2\text{H}_2\text{Cl} = 36.7$. The large value for C_2H_2 is an example of the great effect of the triple bond, which confirms the theoretical relation of magnetic rotation to refraction. E. R. SCHIERZ

Magnetic susceptibility of nitric oxide at 296°K . and 216°K . FRANCIS BITTRE. *Proc. Nat. Acad. Sci.* 15, 638-42(1929). Measurements were made on the suscepti-

bility of NO at room temp. and at that of solid CO₂, by observing the torque exerted on a test body when surrounded by the gas and suspended in a non-homogeneous magnetic field. The deflections observed are treated as linear functions of the pressure from approx. 2 cm. to 76 cm. although the exptl. points depart slightly from the straight lines drawn, as would be expected since the position of the test-body relative to the field changes with the deflection. The deflections for NO are compared with those obtained for air under the same conditions and it is shown that the results are in excellent agreement with the theoretical calcs. of Van Vleck (cf. *C. A.* 22, 2319). W. W. S.

The dielectric constant of some metallic vapors. F. KRÜGER AND F. MASKE. *Physik. Z.* 30, 314-20(1929).—The dielec. consts. of Hg and K vapors were measured by the direct method from 1 to 10 cm. Hg. Maxwell's relation does not hold because of the proximity to an infra-red absorption band (near $1-2\mu$ for Hg). At the lower pressures the dielec. const. is proportional to the pressure. The Clausius Mosotti formula therefore does not hold. This fact is related to the Herzfeld theory of the metallic state. F. R. BICHOWSKY

Electric moments of some substitution products of benzene and biphenyl. ARNOLD WEISSBERGER AND JOHN W. WILLIAMS. *Z. physik. Chem., Abt B*, 3, 367-76(1929).—The elec. moments of a no. of *p*-disubstitution products of benzene were found on the basis of Debye's theory, and analogous compds. of biphenyl were tested to see if similar moments were found for these. Two derivs. of benzene and biphenyl were used in addn., in which the substituents were adjacent. The methods employed were those formerly used by Williams and Krchma (*C. A.* 21, 3151) and Williams and Weissberger (*C. A.* 22, 4347). Biphenyl, 4,4'-dinitrophenyl and 4,4'-dichlorobiphenyl have no elec. moment. The usual formulas for these compds. will explain this result as well as the arrangements with co-axial, twisted rings. In contrast with these, other *p*-disubstitution products have considerable elec. moments. These compds. contain O linkings in which the valency linkings are mutually inclined. Formulas which would explain this are discussed, and some light is thrown on the structure of biphenyl compds. by this method of investigation. B. C. A.

Law of the paramagnetization of a crystal and the law of the paramagnetic rotatory dispersion. JEAN BECQUEREL AND W. J. DE HAAS. *Proc. Acad. Sci. Amsterdam* 32, *Z. Physik* 57, 11-29, 578 89(1929).—See *C. A.* 23, 4385. W. W. STIFLER

Law of the paramagnetic rotation of tysonite and tables of the paramagnetic rotatory power of some crystals. JEAN BECQUEREL AND W. J. DE HAAS. *Proc. Acad. Sci. Amsterdam* 32, 590-6(1929).—The hyperbolic tangent law for the paramagnetic rotatory power of tysonite (cf. preceding abstr.) indicates a reversal of the sense of the magnetic moment of Ce⁺⁺⁺. Also, although the results of B. and de H. indicate a magnetic moment of 1 Bohr magneton, Hund, from spectroscopic data, deduced the value 2.14 magnetons for the fundamental state and this result agrees with the value given by direct measurements. Since the rotatory power is connected with the unequal absorptions of circular vibrations of opposite sign, the absorption bands and the dissymmetries in absorption demand especial study. For this purpose detailed tables of the rotations at $H = 26.73$ kilogausses for a no. of wave lengths at various low temps. are given for tysonite, parisite, and bastnäsite. W. W. STIFLER

Determination of the susceptibility of erbium sulfate at low temperatures. W. J. DE HAAS, E. C. WIERSMA AND W. H. CAPEL. *Proc. Acad. Sci. Amsterdam* 32, 739-44 (1929).—The app. used by Woltjer and Kamerlingh Onnes in their work on Gd sulfate (cf. *C. A.* 18, 495) was improved so as to give greater accuracy and increased temp. range. Measurements were made on a sample of Er₂(SO₄)₃·8H₂O at various temps. from 285°K. to 14.34°K. The results show that this compd. follows the law $\chi(T + 1.9) = C$, where $C = 10.16$. This gives a magnetic moment of 44.82 Weiss magnetons or 9.001 Bohr magnetons. Full exptl. details and data are given. W. W. S.

Anomalous magnetic properties at low temperatures: anhydrous ferrous chloride. H. R. WOLTJER AND E. C. WIERSMA. *Proc. Acad. Sci. Amsterdam* 32, 735-8(1929).—Measurements on anhyd. FeCl₂ at several temps. between 291°K. and 63°K., in fields between 4.6 and 14 kilogausses show that within this range the susceptibility, χ , is const. for all field strengths and follows the law $\chi(T - 20.4) = \text{const.}$ At liquid-H temps. (24.3 to 14.1°K.), anomalies appear. For values of H between 1.8 and 13.8 kilogausses, χ at first increases rapidly, then reaches a max., and then decreases more gradually as H is increased. The max. occurs at higher fields as the temp. is lowered but the value of χ increases with temp. in this region. W. W. STIFLER

Measurement of dielectric constants and of apparent conductivity of insulating materials for high frequency. H. KÜHLEWEIN. *Z. tech. Physik* 10, 280-8(1929).—The principle of the method is the taking of resonance curves with and without the

exptl. condenser. From the damping effect the cond. follows. The exptl. condenser consisted of 2 brass plates of 8 cm. diam., the exptl. dielec. of a 4×4 cm. disk. Theory, calcs. and errors are discussed. Curves and data of ϵ and κ/ω as a function of λ are given for hard rubber, troilite, slate and asbestos slate, marble, stabilite, red and black fiber, celloid, celluloid, pressed wood, galalith, pertinax, quartz glass, amber, glass and mica. The quotient κ/ω is used as a measure of the quality of the dielec. material as to damping; it is named the "frequency conductivity." B. J. C. v. D. H.

The theory of isomorphous growth continuation (oriented separation) of ion crystals on one another. I. N. STRANSKI. *Z. physik. Chem., Abt. A*, **142**, 453-66(1929); cf. *C. A.* **22**, 4289. —The amt. of supersatn. necessary for a substance of the NaCl type to grow on an AB type such as PbS is the max. soly. in the adsorption layers at the PbS surface. This amt. of supersatn. is calcd. from the work of sepn. of ions from the crystal. For NaBr growth on PbS, the calcd. results agree with the exptl. Crystals of the type AB with doubly charged ions sep. from soln. as the smallest possible individuals. ARTHUR FLEISCHER

Isomorphous growth continuation of ion crystals on one another. I. N. STRANSKI AND K. KULELIEW. *Z. physik. Chem., Abt. A*, **142**, 467-75(1929); cf. preceding abstract. —By means of Volmer and Weber's (*C. A.* **20**, 1928) app. the supersatn. for growth of NaNO₃ on siderite, rhodochrosite and calcite crystals from 50° to 80° and NaBr on PbS above 57° was studied. The carbonate crystals had to be freshly cut for crystal growth to occur. For a definite temp. the supersatn. at which sepn. on another crystal can occur is a const. depending on the crystal and the solvent. No sepn. of NaBr on PbS occurs above 50.7° since the supersatn. is too small. ARTHUR FLEISCHER

Producing long single crystals of metal and a study of the factors influencing crystal orientation and perfection. ALEXANDER GOETZ AND MAURICE F. HASLER. *Proc. Nat. Acad. Sci.* **15**, 646-56(1929). —The 3 principal methods for prepg. long single crystals are discussed critically and details are given for prepg. long single crystals of Bi. The molten metal is introduced into a suitable soda-glass tube by a technic which insures its purity and perfect contact with the glass. The tube is then drawn through an elec. furnace at such a speed that the Bi is melted and the glass softened. A suitable mechanism draws the glass and the enclosed metal out to about 3 times the original length. In this way crystals of uniform cross-section, 1 to 2 mm in diam. and 1.5 m. long, were produced. The various factors which det. the orientation of the crystal (*i. e.*, the angle between its main axis and the axis of the rod) are discussed and the influence of the strains applied to the crystal during its formation are especially emphasized. W. W. STIFLER

Compressibility of crystals. R. F. MEHL AND R. H. CANFIELD. *Nature* **124**, 478-9(1929). —The suggestion made by Rashevsky (*C. A.* **23**, 2878) that internal cracks in crystals may be entirely responsible for the observed compressibility coeffs. and that perfect crystals may have no compressibility coeff. at all is here criticized. It is shown that the inter-relationships in the compressibility coeffs. of the elements and the relationships of these coeffs. to other phys. properties are explicable only upon an assumption of validity for the compressibility coeff., and that the d. calcd. from the diffraction of x-rays the abs. wave lengths of which have been measured precludes any finite vol. to the postulated cracks. ROBERT F. MEHL

A note on coordination numbers. F. I. G. RAWLINS. *Trans. Faraday Soc.* **25**, 283-5(1929). —The coordination no., *C.N.*, is the no. of atoms or ions of kind *A* that surround another atom of kind *B* at equal distances in the crystal lattice. The process of sublimation is conceived as a change in *C.N.* or r (inter-nuclear distance), or both. This view tends to stress the conservation of the mol. in passing through a change of state. *C.N.* is important in detg. the degree of complexity of the infra-red spectra of crystals. In the Perovskite family of minerals, which have the general formula ABX_3 and crystallize in the cubic system, the radius ratio $Q = r_B/r_X$ always falls within the prescribed limits for either the rock salt or Ni arsenide structures with *C.N.* = 6. This suggests the preservation of certain at. arrangements intact. The deformability ratio for the elements *B* and *X* may have a considerable share in detg. the crystal type assumed by a compd. ABX_n . Crystals of constitution ABX_3 and ABX_4 are classified according to the *C.N.* of the BX_n "skeleton" M. W. S.

The preparation of projection diagrams. F. E. WRIGHT. *Am. Mineral.* **14**, 251-8(1929). —Equations used as the basis for the projection plots of gnomonic, stereographic, orthographic, angle projection and reflection projection plots are derived and listed, and the several projections compared from this viewpoint. A new type of projection is described which serves to project the entire sphere within a circle of unit radius. A. M. BRANT

Crystal structure of the elements and its relation to the periodic system. F. VON WOLFF. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 265-86(1928).—Tables and graphs are given to show the relation of crystal structure to phys. properties of the elements for which data have been detd. J. F. SCHAIER

The significance of symmetry centers for the derivation and systematics of the 32 crystal classes. J. J. P. VALETON. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 763-84(1928). J. F. SCHAIER

Characteristic properties of the typical harmonic crystal units. GEORG KALB. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 817-22(1928). J. F. SCHAIER

A new rotating-crystal method. ADOLF GELLER. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 945-72(1928).—A description of a new app. for study of crystal structure. J. S. SCHAIER

The relation of gas bubbles on the surface of growing crystals to the acceleration of crystallization. F. BERNAUER. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 1131-48(1928). J. F. SCHAIER

Crystal growth. K. SPANGENBERG. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 1197-1302(1928).—A math. treatment of the factors involved. J. F. SCHAIER

Kinematics of the growth of crystals. I. E. ERNST. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 501-40(1928).—A theoretical, math. analysis. J. F. S.

The universal symmetry elements. P. NIGGLI. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 617-30(1928).—A theoretical discussion of the symmetry elements of crystals. J. F. SCHAIER

The tetrahedral carbon atom and the crystal structure of pentaerythritol. ARTHUR SCHLEEDE AND ERICH SCHNEIDER. *Z. anorg. allgem. Chem.* 168, 313-21(1928).—The evidence for the pyramidal C atom found by Mark and Weissenberg (C. A. 18, 347) in their crystal structure studies of pentaerythritol depends essentially upon the existence of a polar tetragonal axis. S. and S. decide that no polar axis exists. Consequently, the point group is S_4 instead of C_4 and the space group is S_4^2 . The C atom required for this structure is tetrahedral and not pyramidal. R. L. HERSHEY

Crystallographic and optical investigations of adrenalone hydrochloride. W. FARER. *Z. Krist.* 70, 497-505(1929).—Crystallographic measurements and other optical data are given for the orthorhombic and monoclinic modifications of adrenalone-HCl. The indices α , β and γ are 1.5166, 1.6255, 1.7605 and 1.5049, 1.6444, 1.7424, resp., for the 2 forms. L. S. RAMSDELL

Chemical crystallography of bismuth-thiourea compounds. C. GOTTFRIED AND H. STEINMETZ. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd. 57, 249-64(1928).—By the rotating-crystal method the consts. of $\text{BiCl}_3 \cdot 3\text{CS}(\text{NH}_2)_2$ were detd. $a = 13.29$, $c = 7.02$, $r = 14.81$ A. U. The unit rhombohedron contains one mol.; translation group T_{rh} ; space group C_3^4 . For the compd. $\text{BiCo}(\text{CN})_4 \cdot 6\text{CS}(\text{NH}_2)_2$, $a = 13.92$, $c = 12.48$, $r = 9.13$ A. U. The unit rhombohedron contains one mol.; translation group T_{rh} ; most likely space group D_{3d}^5 . J. F. SCHAIER

The crystal structure of picric acid. M. A. BREDIG AND H. MÖLLER. *Z. Krist.* 71, 331-43(1929).—Picric acid is orthorhombic, space group C_{2v}^5 . The unit cell contains 8 formula weights and has the dimensions: $a = 9.25$, $b = 19.08$ and $c = 9.68$ A. U. The structure is built up of unsymmetrical pairs of $\text{C}_6\text{H}_2\text{N}_3\text{O}_7$ groups, with 4 of these pairs in the unit cell. L. S. RAMSDELL

The structure of three organic substances. A. BURGONI, F. HALLA AND O. KRATKY. *Z. Krist.* 71, 263-8(1929).—*D*-Tyrosine-HCl is monoclinic sphenoidal, with space group C_2^2 . There are 4 mols. in the unit cell, which has $a = 5.03$, $b = 8.97$ and $c = 22.50$ A. U. Tetramethyl methanetetra-carboxylate is tetragonal, with $a = 9.12$ and $c = 7.02$ A. U. There are 2 mols. in the unit cell, and the space group is probably C_{4h}^1 . *o*-Toluenesulfonamide is tetragonal bipyramidal, with $a = 18.18$ and $c = 9.15$ A. U. There are 16 mols. in the unit cell, and the space group is C_{4h}^2 . L. S. RAMSDELL

A hydrocarbon model. A. MÜLLER. *Trans. Faraday Soc.* 25, 347-8(1929).—X-ray examn. of a single crystal of the normal paraffin $\text{C}_{22}\text{H}_{46}$ gives the following data: $a = 7.45$; $b = 4.97$; $c = 77.2$ A. U., where a , b and c are the lengths of the axes of the orthorhombic cell. Four pairs of mols. are present in this cell. A figure shows a model of such a normal paraffin. MERRILL W. SEYMOUR

Some examples of information obtainable from the long spacings of fatty acids. S. H. PIPER. *Trans. Faraday Soc.* 25, 348-51(1929).—The long spacings of the fatty acids may be used to det. compn. only when conditions are carefully controlled. Under different conditions, the even acids show at least three forms, A, B, C, and the odd acids

at least four, A' , B' , C' , D' . Identification of a pure acid is best made by taking a photograph at a few degrees below its m. p., since it will then show a C spacing if even, and C' if odd. Some equimol. mixts. of odd and even acids give photographs similar to those from pure acids, and sometimes have the spacings of pure acids. Both in spacings and in m. ps. these mixts. show alterations resembling those of the pure odd and even acids.

MERRILL W. SEYMOUR

The structure of some fundamental aromatic compounds. J. HENGSTENBERG AND H. MARK. *Z. Krist.* 70, 283-96(1929).—Biphenyl: $a = 8.22$, $b = 5.69$, $c = 9.50$ A. U.; $\beta = 94.8^\circ$; space group C_{2h}^5 ; 2 mols. in unit cell, each with symmetry C_i . Phenanthrene: $a = 8.60$, $b = 6.11$, $c = 19.24$ A. U.; $\beta = 98^\circ 15'$; space group C_{2h}^5 ; 4 mols. in unit cell. Fluorene: $a = 8.48$, $b = 5.73$, $c = 19.24$ A. U.; $\beta = 101^\circ 53'$; space group C_{2h}^5 ; 4 mols. in unit cell. Bibenzyl: $a = 12.82$, $b = 6.18$, $c = 7.74$ A. U.; $\beta = 116^\circ$; space group C_{2h}^5 ; 2 mols. in unit cell. Stilbene: $a = 12.42$, $b = 5.73$, $c = 16.0$ A. U.; $\beta = 114^\circ$; space group C_{2h}^5 ; 4 mols. in unit cell. L. S. R.

The structure of the benzene ring in $C_6(CH_3)_6$. KATHLEEN LONSDALE. *Proc. Roy. Soc. (London)* A123, 494-515(1929).—An x-ray examn. of the crystal structure of $C_6(CH_3)_6$ shows that the min. cell contains 1 mol. with axes of 9.010, 8.926 and 5.344 A. U., corresponding to the 3 axes of the triclinic crystal. The structural factors for a large no. of planes have been calcd. and indicate a hexagonal structure in the (001) zone. The mol. is shown to exist in a ring form and the Me groups as well as the benzene C atoms all lie in 1 plane. The Me C atoms have a different scattering effect from that of the ring C atoms.

WALLACE R. BRODE

X-ray evidence on the structure of the benzene nucleus. KATHLEEN LONSDALE. *Trans. Faraday Soc.* 25, 352-66(1929).—A review of the theories concerning the nature of the benzene ring. Data are presented on an x-ray study of certain benzene ring compds. including hexamethylbenzene (cf. preceding abstr.). W. R. B.

Regional absorption of dyes by growing crystals. ARTHUR G. MILLIGAN. *J. Phys. Chem.* 33, 1363-73(1929).—Alum crystals from solns. colored with chlorazol sky blue F-F, methyl violet, eosins and other dyes show three general tendencies: some dyes are pptd., some are regionally absorbed on cube faces and others on octahedron faces. Absorbed dyes favor the development of the absorbing faces by retarding the deposition of salt upon them. $NaClO_3$ with phloxine and croceine scarlet 3B, oxalic acid with rhodamine and Rochelle salts with 3B and F-F also show regional absorption. M. suggests that the explanation of the absorption of one dye by one form and of another dye by a different form is electrical, the crystal lattice attracting dye ions of opposite sign.

MARY E. LEAR

The crystal structure of solid nitrogen. L. VEGARD. *Naturwissenschaften* 17, 543; *Nature* 124, 267, 337(1929).—X-ray diagrams of solid N were analyzed and the structure assumed to be cubical with unit cell dimension of 11.3 A. U. including 64 N atoms in cube-centered arrangement, probably group O_h . *Ibid* 672.—The unit cell of solid N can be reduced to half its previous size; the new dimension is 5.65 A. U. with 8 N atoms. The cubical structure, group T_d has a decidedly mol. lattice, similar to that of $NaClO_3$. The mols. are found in the 4 non-intersecting trigonal axes of the cell. The center-to-center distance of the atoms in the mol. is between 1.0 and 1.2 A. U. This structure is approx. one of closest ball packing; the distance of two "touching" mols. is about 4.0 A. U. Optical activity is expected for this structure.

B. J. C. VAN DER HORVEN

Note on Mr. King's paper: "The crystal structure of strontium." F. SIMON AND E. VOISEN. *Proc. Nat. Acad. Sci.* 15, 695(1929); cf. *C. A.* 23, 3836. E. J. C.

The crystal structure of barium. A. J. KING AND G. L. CLARK. *J. Am. Chem. Soc.* 51, 1709-11(1929); cf. *C. A.* 22, 4288.—The crystal structure of pure Ba was detd. by the powder method at room temp. Ba crystallizes on a body-centered cubic lattice with $a_0 = 5.015 \pm 0.003$ A. U. The atomic radius calcd. from this value is 2.171 A. U. A. J. K.

The lattice structure of nickel. S. VALENTINER AND G. BECKER. *Naturwissenschaften* 17, 639-40(1929).—The results of Bredig and Allolio (*C. A.* 21, 2204) on hexagonal structure of Ni dispersed in H_2 could not be confirmed. Pure Ni wire had a cubical face-centered lattice, const. 3.51 A. U., regardless of heat treatment (up to 1000°). The same structure was found for Ni sheet and for powd. Ni from dispersion in H_2 . It is suggested that B. and A. had an impure product. B. J. C. v. D. H.

The lattice constant of pure α -iron. GEORG MAYER. *Z. Krist.* 70, 383-4(1929).—The av. of 60 independent measurements from films taken from 40 preps. of pure Fe

(from decompn. of $\text{Fe}(\text{CO})_5$) gave the value of 2.86106 0.00003 A. U. for the side of the unit cube, at 22° . L. S. RAMSDELL

An x-ray study of the system iron-arsenic. GUNNAR HÄGG. *Z. Krist.* 71, 134-6 (1929).—Alloys with an As content as high as 56.9% were studied. At room temp. α -Fe will hold approx. 5% As in soln. With increasing As the first compd. is Fe_2As , which has a simple tetragonal lattice. There are 2 mols. in the unit cell, with $a = 3.627$ and $c = 5.973$ A. U. The Fe atoms do not all seem to be structurally equiv. No Fe_3As_2 phase was revealed by the x-rays. Microscopic study indicated such a compd. stable above 795° , below which it breaks down to Fe_2As and FeAs. The compd., FeAs, has a simple orthorhombic lattice, with $a = 3.366$, $b = 6.016$ and $c = 5.428$ A. U. This unit cell contains 4 mols., and an arrangement of atoms is suggested which is a deformed NiAs structure. L. S. RAMSDELL

An x-ray analysis of the iron-boron system. T. BJURSTRÖM and H. ARNFELT. *Z. physik. Chem., Abt. B*, 4, 469-74 (1929).—An x-ray analysis of the Fe-B system showed that in the region of concns. between 0 and 10%, 2 crystal phases, Fe_2B and FeB, appear. The former has a body-centered tetragonal lattice, the dimensions of the elementary parallel piped being, $a_1 = 5.099$ A. U., and $a_2 = 4.240$ A. U. The elementary cell contains 4 of the groups, Fe_2B . The phase FeB has a rhombic lattice defined by the parameters, $a_1 = 5.495$ A. U., $a_2 = 4.053$ A. U. and $a_3 = 2.946$ A. U. The elementary cell contains 4 of the groups FeB. The investigation is being continued in the hope of finding phases of greater B concn. C. J. HUMPHREYS

An x-ray investigation of the gold mercury system. ADOLF PAIST. *Z. physik. Chem., Abt. B*, 3, 443-55 (1929).—Earlier work on Hg and Au amalgams is reviewed briefly (cf. C. A. 13, 1342, 3099; 16, 1064; 20, 1210). An Hg alloys of varying percentage compns. were examd. by the powder method of x-ray analysis. A mixed crystal having a face-centered cubic lattice characteristic of Au occurs with small amts. of Hg, attaining a max. lattice const. of 4.107 ± 0.004 A. U. with 15% Hg. A hexagonal phase appears with Hg concns. of 20% or greater, with a structure approximating hexagonal close packing. The lattice consts. for 25% Hg are $a_0 = 2.908$ A. U., $c_0 = 4.791$ A. U., $c_0/a_0 = 1.647$. There are several other phases of still undetd. structures with greater Hg concns. C. J. HUMPHREYS

X-ray analysis of the copper antimony and silver antimony systems. V. WESTGREN, G. HÄGG and S. ERIKSSON. *Z. physik. Chem., Abt. B*, 4, 453-68 (1929); cf. C. A. 19, 3240; 20, 2654. —Cu-Sb and Ag-Sb alloys of various compns. were examd. by x-ray crystallographic methods, and an attempt was made to det. the extent of the regions of homogeneity of the crystal forms of hexagonal close packing appearing in both systems. Alloys of low Sb content show mixed crystal forms with the face-centered cubic lattice characteristic of pure Cu or Ag. Ag-Sb alloys with 25% Sb have a rhombic lattice which can be regarded as a very slightly deformed hexagonal close packing structure. Cu-Sb has tetragonal symmetry and since this structure is similar to that of the well known Fe_2As alloy, a point of attack on the former is provided. C. J. HUMPHREYS

Intermetallic compound having a simple cubic lattice. ATOMI OSAWA. *Nature* 124, 14 (1929).—Sb-Sn alloys contg. 43, 50 and 55% Sb gave x-ray diffraction lines belonging to a simple cubic lattice. It is concluded that the range between 43 and 55% Sb is a solid soln. of the compd. and one of the components. W. WEST

The constitution and the structure of ultramarine. F. M. JAEGER. *Trans. Faraday Soc.* 25, 320-45 (1929); cf. C. A. 23, 2336. The general properties and methods of prep. the ultramarines are reviewed. The degree of substitution of Na by Ag in ultramarine depends upon the concn. of the solns. used, the duration of the heating, and the state of subdivision of the ultramarine. The time-% substitution curves for reaction in aqueous soln. are characteristic of surface reactions where a gradual satn. of the surface is reached. The structures of the ultramarines were studied by means of x-ray analysis of the powders. All the ultramarines, *nocean* and *hauyne* gave identical spectrograms. *Sodalite* had an entirely different spectrogram. The fundamental grating of the ultramarines, *nocean* and *hauyne* at first appears to be a body-centered cubic one with an edge of the cubic cell equal to 9.13 A. U. The elementary cell of *nocean* contains $\text{Na}_{10}\text{Al}_6\text{Si}_6\text{O}_{38}\text{S}_2$ in the simplest case, while in the ultramarines there is only 1 mol. of the substance with 6 Si atoms in the cell. *Sodalite* has a simple cubic grating with an edge of 8.81 A. U. Its elementary cell contains $\text{Na}_8\text{Al}_6\text{Si}_6\text{O}_{38}\text{Cl}_2$. A silver ultramarine corresponding closely to the formula $\text{Ag}_8\text{Na}_2\text{Al}_6\text{Si}_6\text{O}_{38}\text{S}_2$ and all silver ultramarines prepd. from differently colored ultramarines showed identical powder-spectrograms different from those of the sodium ultramarines with respect to the relative intensities of the diffraction lines. The grating const. in the silver ultramarines is diminished to about 8.93 A. U. The substitution of S by Se does not, in

general, influence the structure appreciably. No connection could be found between the nature of the underlying silicate in ultramarines and of silicates of the nephelite or analcite type. The structure of the ultramarines is detd. by a fixed group, $\text{Na}_8\text{-Al}_5\text{Si}_6\text{O}_{21}$; this is the hexakistetrahedral group T_4^2 . The other atoms are assumed to be wandering, in accord with the chem. behavior of the substances. It is believed that all of the ultramarines are mixtures of isomorphously analogously constituted substances. The sum of the Al and Si atoms is probably 12, and since the diffracting power of these atoms is nearly the same, ultramarines in which one or more places of an Al ion are occupied by a Si ion will yield practically identical spectra with those containing 6 Al ions and 6 Si ions. The colors of the ultramarines are believed to be due to the wandering S and alkali atoms that may form ions of the types NaS'_2 , NaS'_3 , NaS'_4 , which are more or less dislocated or dissociated continually. The phenomena are believed comparable to the blue color developed when KCNS is heated above its m. p.

MERRILL W. SEYMOUR

The space group of stibnite, Sb_2S_3 . C. GOTTFRIED AND E. LUBBERGER. *Z. Krist.* 71, 257 (1929). The space group of stibnite is V_{16}^{16} . There are 4 mols. in the unit cell which has the dimensions $a = 11.39$, $b = 11.48$ and $c = 3.89$ A. U. L. S. R.

The fine structure of gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). Ettore Onorato. *Z. Krist.* 71, 277 (1929). By using the customary value for β ($98^\circ 58'$) a unit cell is derived with $a = 10.47$, $b = 15.15$ and $c = 6.28$ A. U. This contains 8 mols., and the space group is C_{2h}^{16} . The at. positions are given. Structurally the H_2O groups are more closely assocd. with the Ca atoms than with the SO_4 groups, so the formula is written $(\text{Ca} \cdot 2\text{H}_2\text{O})\text{SO}_4$. Since all of the H_2O groups are equiv. the structure furnishes no explanation of the loss of $\frac{3}{4}$ of the H_2O in the forming of "hemihydrate." The relations between the structures of gypsum and anhydrite are discussed. L. S. R.

Atomic arrangement in the silicates. W. LAWRENCE BRAGG. *Trans. Faraday Soc.* 25, 291 (1929). A summary is given of published results of the x-ray analysis of a number of silicates, particularly a series examd. in the lab. of the author. The methods of working out the complex structures from the x-ray data are outlined. Diagrams are given for a number of typical structures. The x-ray diffraction measurements indicate that the Si and O atoms in the SiO_4 group are only partly ionized. The main features of the silicate structures are thus summarized: (a) the structures are typical coordination structures; (b) Si is always situated within a tetrahedral group of 4 O atoms, Be is between 4 O atoms in some structures and presumably in all; Al is generally found between 6 O atoms at the corners of an octahedron but fits into groups of different shapes; Mg and Fe occur between 4 or 6 O atoms; Ca is surrounded by a very distorted tetrahedral group, by 6 O atoms, or by 8; (c) certain general features of all the arrangements of atoms are those naturally expected from an assembly of oppositely charged ions. The models of all the structures give an impression of mechanical stability.

MERRILL W. SEYMOUR

The crystal structure of potassium chlorate. W. H. ZACHARIASEN. *Z. Krist.* 71, 501 (1929). KClO_3 is monoclinic holohedral. The dimensions of the cell contg. 2 mols. are: $a = 4.647$, $b = 5.585$, $c = 7.085$, $\beta = 103^\circ 38'$. The space group is C_{2h}^{16} . At. positions are derived entirely from abs. intensity measurements. Each K atom is surrounded by 9 O atoms at an av. distance of 2.94 A. U. ClO_3 groups are present, with the Cl atom displaced 0.5 A. U. from the plane of the O atoms. The av. distance $\text{Cl-O} = 1.48$ A. U. and $\text{O-O} = 2.38$ A. U. There is a marked similarity of this structure to that of calcite, especially with reference to the O atoms, and thus the analogous optical properties, cleavage, twinning, etc., of these 2 substances are explained. L. S. RAMSDELL

The crystal structure of sodium chlorate. W. H. ZACHARIASEN. *Z. Krist.* 71, 517 (1929). NaClO_3 is cubic tetartohedral. The unit cell contains 4 mols. and $a = 6.570 \pm 0.006$ A. U. The space group is T^4 . Each Na atom is surrounded by 6 O atoms, 3 of them at a distance of 2.459 and 3 at a distance of 2.455 A. U. The ClO_3 group is practically identical with that in KClO_3 . The unusual features of this ClO_3 group are discussed. The at. positions and cell dimensions check closely with those of Dickinson and Goodhue (*C. A.* 16, 678). L. S. RAMSDELL

The lattice constant of barium telluride. V. M. GOLDSCHMIDT. *Z. Krist.* 69, 411 (1929). Samples of BaTe were prepd. by direct union of the elements in an atm. of H_2 . Independent measurements by 3 observers on different films gave an av. value for the cube edge of 6.096 ± 0.002 A. U., which is larger than the values obtained by Hasse (6.82 and 6.86 A. U.) cf. *C. A.* 22, 4291. L. S. RAMSDELL

The structural relationships of the alkali sulfates. B. GOSSNER AND F. MUSSONUG. *Z. Krist.* **69**, 446-54(1929).—The lattice consts. of Na_2SO_4 are: $a = 9.79$, $b = 5.89$, and $c = 12.31$ A. U. There are 8 mols. in the unit cell and the space group is V^{24} . At. positions are given. This structure is compared with those of KLiSO_4 , $\text{K}_2\text{Na}(\text{SO}_4)_2$, and K_2SO_4 (cf. *C. A.* **19**, 2764; **23**, 1790). L. S. RAMSDELL

The space group of potassium sulfate. W. EHRENBERG AND C. HERMANN. *Z. Krist.* **70**, 163-70(1929).—The space group of K_2SO_4 is found to be V_h^{16} , confirming the results of previous workers (cf. *C. A.* **22**, 1879-80). Possible at. positions are discussed. L. S. RAMSDELL

The lattice constants of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. B. GOSSNER AND K. BRÜCKL. *Z. Krist.* **69**, 422-6(1929).—There are 2 mols. of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ in the unit cell, which has the following consts.: $a = 6.07$, $b = 10.78$, $c = 5.89$ A. U.; $\alpha = 82^\circ 5'$, $\beta = 107^\circ 8'$ and $\gamma = 102^\circ 41'$. The angle values are based on goniometric measurements. L. S. RAMSDELL

The crystal structure of the anhydrous alums $-\text{R}^+\text{R}^{+++}(\text{SO}_4)_2$. L. VEGARD AND ALF MAURSTAD. *Z. Krist.* **69**, 519-32(1929).—The space group of the anhyd. alums is D_3^2 , and the hexagonal unit cell contains 1 mol. The values for a , c and a/c are: $\text{KAl}(\text{SO}_4)_2$ —4.706, 7.960 A. U., 1.692; $\text{NH}_4\text{Al}(\text{SO}_4)_2$ —4.724, 8.225 A. U., 1.740; $\text{NH}_4\text{Fe}(\text{SO}_4)_2$ —4.825, 8.310 A. U., 1.723; $\text{KCr}(\text{SO}_4)_2$ —4.737, 8.030 A. U., 1.696, resp. The ionic radii for $\text{KAl}(\text{SO}_4)_2$ are calcd., and the coordinate positions are given. L. S. RAMSDELL

The crystal structure of potassium chloroplatinate. W. A. FREDERIKSE AND H. J. VERWEEL. *Rec. trav. chim.* **47**, 904-8(1928).—Powder photographs with $\text{Cu K}\alpha$ rays prove the space group O_h^5 to be correct for K_2PtCl_6 . The unit cell edge is 9.73 ± 0.03 A. U. The parameter values were calcd. from the intensity of the diffraction lines. The intensities were detd. partly with a photomicrometer and partly visually. Investigation shows that the angle dependence of scattering power may not always be neglected in calcn. of parameters. The parameter is 0.235, whence the distance between Cl and Pt atoms is 2.29 A. U. R. L. HERSHEY

The structure of tetramethylammonium perchlorate and permanganate. KARL HERRMANN AND WILHELM ILGE. *Z. Krist.* **71**, 47-63(1929).—The space group of $(\text{CH}_3)_4\text{NClO}_4$ and $(\text{CH}_3)_4\text{NMnO}_4$ is D_{4h}^2 and there are 2 mols. in the tetragonal unit cell. For the perchlorate $a = 8.290$ and $c = 6.006$ A. U. and for the permanganate $a = 8.439$ and $c = 6.019$ A. U. The lattice is built up of $\text{N}(\text{CH}_3)_4$ and ClO_4 (or MnO_4) ions, which have the form of tetragonal bisphenoids. L. S. RAMSDELL

The space group of pentaerythritol tetraacetate. I. E. KNAGGS. *Z. Krist.* **70**, 185-6(1929).—Six rotation photographs are reproduced showing the absence of odd-order reflections from the (001) plane, thereby proving that the space group must be C_{4h}^4 (cf. *C. A.* **23**, 2084). L. S. RAMSDELL

X-ray examination of a system of mixed crystals with monoxide components. SVEN HOLGERSSON AND ALDO KARLSSON. *Z. anorg. allgem. Chem.* **182**, 255-71(1929).—Mixed crystals in the systems: CoO-MgO , NiO-MgO , CoO-NiO were studied by the Debye-Scherrer method. The prepn. of the mixed crystals using KCl as flux is described. The dried ppt. of the mixed oxides gave the same x-ray diagram as the mixed crystal prepd. by fusion. The change in color of the mixts. with compn. is given. A continuous miscibility is observed in the three systems, fulfilling Vegard's law: the linear dimensions of a lattice are additive from the linear dimensions of the elements interchanged. The x-ray diagrams of MgO , CoO and NiO are analyzed; the structure is NaCl type, a being in each case, 4.22 A. U., 4.26 A. U. and 4.18 A. U. S. LENHNER

Extension of Avogadro's law. IONEL N. LONGINESCU. *J. chim. phys.* **26**, 312-3(1929).—The no. of simple mols. in equal vols. of gases or liquids at the same temp. is proportional to the total pressure. If the internal pressure of various liquids is the same then their d is a measure of their mol. wt. FRANK URBAN

The compressibility of carbon monoxide at 0° and above 50 atmospheres. SVERIANO GOIG. *Compt. rend.* **189**, 246-8(1929).—When CO is compressed from 53.58 to 127.67 atm., the deviation among values of p/v is less than 0.02%, CO thus having a normal compressibility. E. G. VANDEN BOSCH

The movement of gases around electrically heated wires. SAM LENHNER AND GUY B. TAYLOR. *J. Am. Chem. Soc.* **51**, 2741-4(1929).—A periodic pressure change was observed in vessels contg. a wire axially placed and electrically heated. The periodic pressure change synchronized with a corresponding fluctuation in the heating current. A hot wire in a gas contg. a mist was surrounded by a zone free of mist. This zone be-

haved like the conduction film assumed to exist around a heated body (Langmuir, *Phys. Rev.*, **34**, 401(1912); *C. A.* **7**, 1323). The diam. of the mist-free zone depended on the wire temp.

A. J. MONACK

The relation between hydrogen pressure and filament resistance in a tube containing glowing tungsten. TERESA J. DILLON. *Proc. Phys. Soc. (London)* **41**, Pt. 5, 546-56(1929).—A two-element, cylindrical tube with W filament and Cu anode in H atm. was examd. for pressure-resistance variations. The resistance of the filament increased progressively as the gas rapidly disappeared, suggesting the possibility of using this device for a pressure gage of Pirani-Hale type. The method outlined was satisfactory for the small range of pressures studied. There appears to be a chem. reaction between the H and W.

M. McMAHON

Characteristic equation of a binary mixture of gases. G. VAN LERBERGHE AND G. SCHOOLS. *Bull. sci. acad. roy. Belg.* [5], **15**, 583-9(1929).—The equation $p = p_1 + p_2 + \omega_1 n_1/v^2$, where p_1 and p_2 are the pressures of the pure gases at the concn. considered, and n_1/v , n_2/v are the specific concns., expresses the exptl. results for CH₄-N₂ mixts. to $\approx 0.3\%$. The equation for fugacity is worked out and an equation for ternary mixts. proposed.

F. R. B.

The oxidation of phosphine at low pressures. R. H. DALTON AND C. N. HINSHELWOOD. *Proc. Roy. Soc. (London)* **A125**, 294-308(1929).—At room temp. a PH₃-O₂ mixt. reacts immeasurably slowly at pressures below a certain critical value of a few mm.; at this critical value an explosion occurs. N₂ or A lowers the pressure at which explosion occurs. In the absence of an inert gas a simple theory leads to the equation $P_{O_2} \cdot P_{PH_3} d^2 = \text{const.}$, where d is the diam. of the reaction vessel. Exptl. results agree in general with the behavior predicted by the above equation. The abrupt transition from practically no reaction to explosion as the pressure is gradually increased is explained by means of a branched-chain reaction mechanism, the limiting pressure being that at which chains begin to multiply more rapidly than they are broken by the walls of the vessel.

P. H. EMMETT

Partial pressures of binary solutions. RALPH W. DORNT. *J. Phys. Chem.* **33**, 1309-31(1929).—The application of the equation proposed by Bancroft and Davis (*C. A.* **23**, 2623) to several other systems is considered, with good agreement over wide ranges of concn. The gas interferometer was used in attempt to secure new data on the system EtOH-H₂O, but wide deviations from values obtained by other methods were found in readings calcd. from calibration on the pure vapors.

T. H. CHILTON

Vapor pressures of lead iodide, cuprous iodide, cuprous bromide, silver iodide and silver bromide by a modified streaming method. KARL JELLINEK AND AUGUST RUDAT. *Z. physik. Chem., Abt. A*, **143**, 55-61(1929).—Vapor pressures were measured for PbI₂, 650-800°; CuI and Cu₂Br, 900-1100°; AgI, 900-1200°; AgBr, 1000-1200°. Mol. heats of vaporization calcd. were 27,700, 18,300, 18,100, 38,600 and 40,800 cal., resp. Mol. formulas in vapor phase are the lowest possible except for that for cuprous iodide, which is Cu₂I₂.

GUY B. TAYLOR

Vapor tensions and the vapor densities of ethylene and nitrous oxide. GEORGE T. BRITTON. *Trans. Faraday Soc.* **25**, 520-5(1929).—A method was devised which enabled the detn. to be made of the vapor pressure of C₂H₄ from -105° to 9° (crit. temp.), and of N₂O from -80.5° to 35.4° (crit. temp.). The densities of N₂O were measured at 20°, 45° and 67°. The pressure-temp. equation of Batschinski fits the data well.

MALCOLM DOLE

Steam tables and equations, extended by direct experiment to 4000 lb./sq. in. and 400°. H. L. CALLENDAR. *Proc. Roy. Soc. (London)* **A120**, 460-72(1928).—The densities of water and steam have been investigated near the crit. point. They are not equal at this point, 374°, but at about 380°, there being an unstable region of equil. between these temps. This is illustrated by curves, which do not agree with those calcd. from a formula of the Thiesen type. The total heat has also been measured for water and for steam, and it is shown that air-free water gives values for H and h which are different from those given by ordinary distd. water, and the curves so obtained agree with those found by the previous method. The equations for the total heat, the entropy and the satn. pressure have been extended, and are discussed. Extended steam tables for the equil. states of steam up to 4000-lb. pressure have been calcd.

B. C. A.

Notes on surface tension. A. W. PORTER. *Phil. Mag.* **7**, 624-30(1929).—Mathematical. P. considers the problems of (1) the rise of a liquid in a capillary tube, (2) the wt. of drops from tubes of various diameters and (3) the vanishing of surface tension near the crit. point. From an analysis of the curvature of the meniscus of the liquid the validity of the assumptions of Rayleigh (cf. *C. A.* **10**, 408) in his treatment of capillary rise, are established. From an examn. of the wts. of liquid drops it was concluded that

the viscosity of the liquid has little influence on the wt. If it is assumed that mols. cannot approach nearer than their diams. it is not necessary to accept Laplace's deduction that vanishing of surface tension can only take place when the densities of the gas and liquid phases are the same. This is offered to confirm the observations of Callendar (cf. preceding abstr.) that the surface tension of water vanishes 6° below the crit. temp.

L. H. REYERSON

The influence of steam on the heat radiation of exploding gas mixtures. The specific heat of steam at high temperatures. KURT WOHL AND GÜNTHER VON FLBE. *Z. physik. Chem., Abt. B*, **5**, 241-71(1929); cf. *C. A.* **18**, 3522.—With the purpose of detg. the disson. of H_2 by the explosion method the explosion of H_2O_2 was studied with an excess of H_2 and an initial pressure of 0.5, 1 and 3 atm. The gases were all dried. The influence of the initial pressure is greater than can be expected from H_2 disson. The loss in radiant heat is greater with smaller initial pressure. The explosion of moist gases is practically adiabatic. The addn. of H_2O does not reduce the time of explosion. The loss of heat in the "dry" explosion is due to luminescent radiation of some of the reaction products, probably OH. The added H_2O extinguishes the luminescence and the energy is absorbed by the H_2O . The effect is different from that found by Garner and Johnson (cf. *C. A.* **22**, 1903), where the addn. of H_2O reduces the time of explosion and thus diminishes the loss of heat. With the "moist" explosion the sp. heat of steam is detd. between 1760° and 2400° . The values differ about 1.3% from those calcd. with the Einstein function.

E. SCHOTTE

The ignition of detonating gas. LADISLAUS FARKAS, PAUL GOLDFINGER AND FRITZ HABER. *Naturwissenschaften* **17**, 674(1929) The chain reaction mechanism of Bonhoeffer and Haber (*C. A.* **23**, 772) requires free H atoms or OH radicals (or O atoms) for the initiation of the detonating-gas reaction. H. and v. Schweinitz (*C. A.* **23**, 1792) confirmed the theory for H atoms. With O the result was likewise pos (O_2 is rather inert toward H_2); O atoms started the reaction. H_2O as sealing liquid for the reaction vessel (100 to 200 mm. Hg pressure) could be replaced by concd. H_2SO_4 .

B. J. C. VAN DER HOEVEN

The role of walls of the containing vessel in gas reactions. MAX BODENSTEIN. *Z. Elektrochem.* **35**, 535-9(1929).—A survey of the historical development of this field and its bearing on kinetics of gas reactions and on modern technical problems. S. L.

A laboratory experiment on the boiling-point curves of non-azeotropic binary mixtures. GEORGE W. BENNETT. *J. Chem. Education* **6**, 1544-9(1929) —In a 500-cc. Claissen flask, with special fittings for removing samples, mixts. of $MeOH-H_2O$, Me_2CO-H_2O and $AcOH-H_2O$ were distd., and the samples analyzed by detg. surface tension of small portions of the liquid by the du Nuoy tensimeter. Values so obtained were then compared with a reference surface tension-compn. curve, and the compn. of the sample was found from this curve. The expt. as outlined is not a precision method, but yields very good b. p. curves of non-azeotropic binary liquid mixts. for both vapor and liquid phases over the entire compn. range. Two students can perform the entire expt. in one afternoon.

W. C. EBAUGH

Superheating and the intensive drying of liquids. S. LENHER. *J. Phys. Chem.* **33**, 1579-82(1929).—Ordinary C_6H_6 , CCl_4 and H_2O are heated over 30° above the normal b. p. without ebullition in reproductions of intensive drying app. The following factors cause superheating: (1) immersion of thermometer in heated liquid, (2) use of liquid heating bath and (3) distn. of liquid removing dissolved gases and dust particles. The supposed fractional distn. of dried C_6H_6 into pseudo-components is due to simple superheating. L. raises objections to Baker's hypothesis that the mol. complexity of liquids is increased on drying.

S. LENHER

Intensively dried carbon tetrachloride. SAM LENHER. *J. Am. Chem. Soc.* **51**, 2948-50(1929).— CCl_4 dried at room temp. with P_2O_5 for 5 years shows no change in b. p. if superheating is prevented. The vapor d. is normal.

S. LENHER

The superficial properties of mercury. E. PERUCCA. *Phil. Mag.* [7], **7**, 418-9(1929).—P. briefly discusses the work of Oliphant (cf. *C. A.* **22**, 4026) and Bircumshaw (cf. *C. A.* **22**, 4025) and points out that his own work (*Atti. Acad. Torino* **57**, 81(1921)) supports the ideas of superficial at. and mol. arrangement on fresh surfaces of Hg.

L. H. REYERSON

The viscosity of viscous liquids. M. VOLAROVICH. *J. Applied Phys. Moscow* **5**, 53-63(1928)(in Russian with English summary); *Physik. Ber.* **9**, 2008. —The viscosity of sugar solns. in glycerol was measured by the Margules method (rotation of 2 concentric cylinders). The viscosity-temp. curves were obtained in the ranges $16-75^\circ$ and 3930 to 2.5 abs. units. The Le Chatelier formula (cf. following abstract) gave results accurate within 1%.

ALBERT L. HENNE

Investigation of viscous liquids. B. V. DERYAGIN AND I. M. KHANANOV. *J. Applied Phys. Moscow* 5, 65-79(1928) (in Russian with English summary); *Physik. Ber.* 9, 2008. —The viscosities of sugar solns. in glycerol and of potato molasses were measured by the falling-sphere method. The Stokes' formula modified by Ladenburg was used in the computations. The temp. range was 14-70°. Within exptl. error, the results agree with those obtained with the Le Chatelier formula: $\log(\eta/\eta_1) = A - BT$, where η_1 and A and B are consts. peculiar to the fluid. ALBERT L. HENNE

The measurement of absolute viscosity by the use of concentric cylinders. H. R. LILLIE. *J. Am. Ceram. Soc.* 12, 505-15(1929).—The method employs the torque exerted upon a stationary inner cylinder, suspended by means of a torsion member into the center of a fluid, when the cylindrical container is given a uniform angular motion. For the castor oil used, the viscosity at 20° is 9.67 poises. C. H. KERR

Viscosity of aqueous solutions of strong electrolytes with special reference to barium chloride. GRINNELL JONES AND MALCOLM DOLE. *J. Am. Chem. Soc.* 51, 2950-64(1929). —By means of a timing device sensitive to 0.01 sec. the relative viscosity of BaCl_2 solns. from 0.005 to 1.0 M was measured at 25°. The data fit accurately the equation $\varphi = 1 - 0.02013 \sqrt{c} - 0.20087 c$, where φ is the relative fluidity and c the molal concn. The equation $\varphi = 1 - A \sqrt{c} \pm Bc$ is a general one for solns. of all strong electrolytes (A and B being empirical consts.). MALCOLM DOLE

The structural viscosity of water solutions of sulfonated oils. W. SCHINDLER AND E. FLASCHNER. *Kolloid-Z.* 48, 328-38(1929).—The viscosity relations of aq. solns. of sulfonated oils were studied with a dynamic viscometer according to the Ostwald-Auerbach method. Aq. solns. of sulfonated castor oil showed a considerable structural viscosity for p_H values of 7.8-8.0. The structural viscosity of strongly alk. solns. of p_H about 10 was much less. This phenomenon was detd. first in solns. of known concn. The values for emulsions prepd. from sulfonated castor oil and toluene, and in the presence of alkali, were less than those of the solns. of the same concn. of the sulfonated oils. Sulfonated blubber showed a structural viscosity in a more limited p_H region than did the castor oil. The value was less than for the castor oil. L. L. QUILL

Investigation of damping liquids for aircraft instruments. G. H. KEULEGAN. *Natl. Advisory Comm. Aeronautics, 14th Ann. Rept. No. 299*, 405-26(1929).—The effect of temp. on the kinematic viscosity was detd. between -18° and +30° for poppy seed, neats'-foot, castor and linseed oils, naphthene-base petrolatum and transformer oil in xylene, glycerol solns. in EtOH and in 50-50 EtOH-H₂O, BuOH and MeOH mixts., kerosene, mineral spirits, xylene and recoil oil. Viscosity data are given as curves in which $\log_{10}(t/t_0)$ is plotted against temp., where t_0 and t are the times of discharge through the viscometer at 30° and θ °. The relation found was $\log_{10}(t/t_0) = \log_{10}(v_{30}/v_\theta)$, where v_{30} and v are the kinematic viscosities at 30° and θ °, resp. Inclometers contain glycerol 40, abs. EtOH 60, which mixt. increases in viscosity 5 times at -10° compared to 30°. BuOH 50 + MeOH 50 is at -20° less than 2.5 times as viscous as at 30°, but at +25° it is one sixth as viscous as the former. Magnetic compasses contain mineral spirits. Only xylene has better temp. properties. In an open dashpot evapn. and oxidation occur. No oil is satisfactory at low temp. "Wintered" neats'-foot oil was the best. E. M. SYMMES

The superposition law of a deformed finite elastic continuum subject to relaxation, and its significance for the exact expression in the Euler form of the equation for viscous fluids. HEINRICH HENCKY. *Ann. Physik* [5], 2, 617-30(1929). F. R. BICHOWSKY

Liquid mixtures of tellurium and sodium telluride. I. Specific resistance as a function of composition and temperature. CHARLES A. KRAUS AND STANLEY W. GLASS. *J. Phys. Chem.* 33, 984-94(1929).—In all cases the sp. resistance of the alloys diminishes markedly with increasing temp. approx. according to an exponential function. At higher concns. of Na, resistance increases regularly with decreasing temp. without singularities until a large discontinuous increase of resistance occurs, indicating the appearance of solid phase, Na_2Te , having a congruent m. p. of 436°. **II. Phase diagram of the system: Te-Na₂Te.** *Ibid* 995-9. —The phase diagram detd. by thermal analysis confirms the existence of Na_2Te , and also of Na_3Te and of Na_3Te_2 . There are two eutectics, of Na_2Te_2 and Na_3Te_2 ; and of Na_2Te_2 and Te. A. P. SACHS

Remarks on diffusion in layer crystals. E. DITTLER. *Z. anorg. allgem. Chem.* 168, 309-12(1928).—D. has examd. some crystals prepd. by C. v. Hauer about 50 yrs. ago and now preserved in the State Museum of Natural History in Vienna. They were prepd. by crystg. certain salts from their solns. upon cores of other isomorphous crystals. A series of alums, vitriols, double compds. of oxalic acid, and ferri- and cobalti-cyanides, in which the lines of demarcation of the 2 kinds of crystals were originally clear and sharp

were examd. for evidence of diffusion of one crystal into the other. In general no such evidence was found. In several cases a blurring of the line was observed, but it was not clear that traces of mother liquor in the core were not responsible. R. L. HERSHEY

Heat equalization in crystals in the light of quantum mechanics. TH. V. KARMAN. *Naturwissenschaften* 17, 385-7 (1929).—A theory is outlined for heat conduction on the basis of Schrödinger's equation. For high temp. the conduction is proportional to $1/T$; at low temp. it approaches a rather high limit. B. J. C. VAN DER HOEVEN

Experiments on persisting currents. W. TUIJN. *Physica* 9, 145-60 (1929).—Earlier expts. on the currents persisting in superconductive metal rings were improved. In 4 expts. the decrease in intensity of the persisting current was less than $1/40,000$ per hr. At each temp. the intensity of the current depends on the magnetic field and the threshold value; below the latter the effects are completely reversible. For a field of 100 gauss the current in the outer ring was 220 amps., inner ring 90 amps. In further expts. a hollow Pb ball of 20 mm outside diam., 0.4 mm thick was used around the inner ring. The attraction between the two bodies was similar to that between two rings, i. e., the currents persistently ran in the same direction on the ball. The phenomenon of these persisting currents can be utilized in various ways for detecting superconductivity. Peculiar differences in effect were observed for an inner ring built of Pb and Sn blocks alternately, of which some have not yet been explained. B. J. C. VAN DER HOEVEN

Superconductivity of thorium. W. MEISSNER. *Naturwissenschaften* 17, 390-1 (1929).—Supercond. was found on a single crystal of Th 12×3 mm; its residual resistance in liquid He was 0.017 of the resistance at 0°C . The point of discontinuity in the resistance is about 1.4° abs. ; at 1.3° the resistance is less than 0.0001 of the resistance at 0°C . The decrease in resistance occurs within a range of 0.2° . The transition point here found is the lowest so far obtained. It decreased in resistance 4 times between 4° and 1.2° abs. B. J. C. VAN DER HOEVEN

The distribution of impurities in zinc single crystals. M. STRAUMANIS. *Z. anorg. allgem. Chem.* 180, 1-10 (1929).—Single crystals of Zn can be prepd. from an impure material; the impurity becomes a constituent of the crystal. Non-isomorphous impurities form strata parallel to the base of the Zn crystal. By appropriate cooling, primary Zn crystals sep. from the fusion; they are so oriented that their bases are parallel to the direction of heat flow. Similarly oriented crystals grow most readily on the prism faces. As a result of the first sepn. of Zn crystals, the fusion liquid sepg. the crystals becomes richer in impurity than the original fusion. (Cd was the impurity studied.) From that Cd-richer fusion Zn seps. at a lower temp.; consequently the growth of the crystals occurs at a gradually decreasing temp. and in a medium gradually becoming richer in Cd. When the eutectic temp. and concn. are finally reached, the liquid between the crystals oriented parallel finally solidifies. If the growth of the crystals is very slow, the eutectic has time enough to sep. completely, and in this case, Cd and Zn crystallize separately. The Cd crystals are forced to adopt the Zn orientation. ALBERT L. HENNE

Dependence of the minimum of the temperature of recrystallization on the basal characteristic values of solids. A. BOCHVAR. *J. Appld Phys. Moscow* 4, 47-53 (1927) (in Russian with English summary); *Physik. Ber.* 9, 36; also in *J. Russ. Met. Soc.* 927, No. 4, Mem. 370 7.-An hypothesis explaining recrystn. is proposed. It is analogous to the Lindeman explanation of fusion. In every solid substance, the amplitude of the atom vibrations at the recrystn. point is a definite fraction of the mean at. distance. By means of this hypothesis and the Lindeman equation, it is found that $T(\text{recrystn.})/T(\text{fusion}) = \text{const.}$ Measurements show that the const. is about 0.38. The lowest recrystn. temps. of several metals were computed, but not yet measured. ALBERT L. HENNE

The recrystallization of easily fusible substances and ice. G. TAMMANN AND K. L. DREYER. *Z. anorg. allgem. Chem.* 182, 289-313 (1929). The recrystn. of fusible org. compds. falls into 2 classes according as the grain size is equal or unequal at the start. When recrystn. starts the crystal grain size becomes very different and finally varies around a mean value following the Maxwellian distribution law. The dependence of velocity of displacement of the grain boundary on fineness of rolling, on temp., and on crystal orientation is discussed. The velocity of grain growth is detd. by concn. of impurities sepg. from the crystallite. These impurities form a honeycomb-like net on the crystal boundary which retards and finally stops the growth of grains. The orientation of one crystallite to another det. the direction of growth; the impurities det. the velocity. A secondary recrystn. is not observed with ice; this is because the film, or net, between crystallites is here liquid. The impurities in snow are Na, K, Mg, Ca, NH_4 , SO_4 , Cl, NO_3 and NO_2 . A growth of the grain boundary is also observed in sublimed films where crystallites have their natural properties. S. LÉNNER

The viscosity of solids. S. ERK. *Z. Metallkunde* 21, 185-9(1929).—All solids have the capacity to flow like liquids of very great viscosity under the action of long-applied forces. Methods of measuring this viscosity may be divided into two classes: the static and the periodic. With the periodic method the viscosity can be calcd. from the damping of the vibrations but this method furnishes erroneous values. The static method measures the permanent change in shape under applied loads and gives correct values, which depend for cryst. substances like metals upon previous treatment. In any case the accuracy is low. The mathematics of the methods is discussed. The failure of the periodic method is explicable upon the basis of the kinetic theory of gases.

ROBERT F. MEHL

Problems of plasticity. Deformation at low temperatures. M. POLANYI AND E. SCHMID. *Naturwissenschaften* 17, 301-4(1929).—A short review of recent work (*C. A.* 23, 3139). Expts. were made to ascertain whether at low temp. elastic limits of crystals become higher and perhaps approach the theoretical limit, predicted from crystal theory (cf. Becker *C. A.* 21, 1385). The results were neg. The restoration of the lattice during slip is, however, considerably less at low temp.; the tension curves become steeper and finally independent of temp. Amorphous substances seem to approach the theoretical value of strength (100 to 1000 kg. per sq. mm.) at low temp. B. J. C. VAN DER HOEVEN

Transformation of undercooled liquids into glasses. G. TAMMANN. *Nachr. Ges. Wiss. Göttingen. Math.-Physik. Klasse.* 1927, No. 4, 457-64.—When a liquid cools to form a glass it passes through a temp. interval in which the substance has a viscosity, a sp. heat and a thermal expansivity that follow laws different from those valid for the temp. intervals above or below. The upper limiting temp., T_g , of this interval seems to be that at which the glass is just sufficiently fluid so that it is possible to draw it out into a fine thread. The lower limiting temp., T_0 , is that at which permanent strain may be caused by differential expansivity between the glass and a container to which it adheres, and result in spontaneous cracks. The question is discussed as to whether the temp. limits are always identical for the intervals in which different properties behave abnormally. The abnormal change of properties in passing from the very viscous state to the brittle, glassy condition is ascribed, not to mol. changes, but to a great increase of the internal pressure.

R. H. LOMBARD

Slip bands produced when crystals of aluminum are stretched. II. Extension at high temperatures. K. YAMAGUCHI AND S. TOGINO. *Sci. Papers Inst. Phys. Chem. Research (Tokyo)* 9, 277-89(1929).—Al crystals were stretched at temps. in the range 500-600°. An analysis of Laue photographs shows the external deformation to be the same as that for single crystals stretched at ordinary temps. The Laue diagrams show none of the so called asterism, indicating that the crystal is not internally strained. Slip bands are produced and measurement of their direction confirms the mechanism as the same as that at lower temps. Other bands appear on the surface and are explained as fissures in a thin oxide film formed during heating. There is no hardening due to extension at high temps. The slip bands are not discontinuous changes of level on the surface but wavy stripes, indicating that the distortion is a perfectly simple shear at any particular point. III. Extension in liquid air. *Ibid.* 289-92.—Single Al crystals were stretched at the temp. of boiling O_2 . Distortion takes place as at ordinary temps; the crystal is, however, harder. There is less slip per plane than at ordinary temp. and the slip bands are shorter, the area of actually slipped zone thus being smaller.

R. L. HERSHEY

An x-ray effect of permanent fracture. U. DEHLINGER. *Naturwissenschaften* 17, 545(1929).—Debye diagrams of strongly rolled Cu or Ag strips far from and near the place where these strips had been fractured by repeated bending showed the K doublet of Cu radiation sharply split up in the fracture zone. In the rest of the strip the usual indistinct lines appeared.

B. J. C. VAN DER HOEVEN

The parachor, an application of surface tension to the constitution of chemical compounds. A. SIPPEL. *Z. angew. Chem.* 42, 849-52, 873-7(1929).—The value of the parachor (cf. *C. A.* 22, 3598) depends on chem. constitution. With normal compds. it is the sum of the at. consts. and of values representing the structure, and may therefore be used to det. the structure of org. and inorg. compds.

FOSTER D. SNELL

Sources of error and calculation in the determination of the surface tension by the ring method or by the microbalance. G. ORBÁN AND L. REINER. *Biochem. Z.* 211, 487-90(1929).—The detn. of surface tension by the ring method is complicated by the circumstance that the wt. at which the film breaks, insofar as this is not done with sufficiently large rings, depends not only on the surface tension and the radius of the ring but also upon the r/a coeff. (radius/square root of the specific cohesion). The function $F(r/a)$ corresponding to this relationship has been detd. for various values of r/a and it

was shown to be unity when $r/a > 3$. This correction ($F(r/a)$) must be introduced also when the detn. is carried out with the microbalance. S. MORGULIS

Effect of some factors on the ring method for determining surface tension. A. H. NIETZ AND R. H. LAMBERT. *J. Phys. Chem.* 33, 1460-7 (1929).—The ring method for detg. surface tension has been considered independent of contact angle. Wire 0.064 in. in diam. coated with a wide range of org. solids was used. The angle of contact was detd. independently by a method not described. The pull F on the ring was found to be a function of the angle of contact θ . The form of the function is $F = 2/T(1 + \cos)\theta$, in which l is the av. perimeter of the ring and is const. for any one ring. $n = k(D/l) - k_1$ over a limited range, when D is the diam. of the wire and k and k_1 are const. F. E. B.

Theory of liquid film formation. C. W. FOULK. *Ind. Eng. Chem.* 21, 815-7 (1929).—A theory is developed based on the resistance of the surface layers of solns. to mech. forces tending to produce uniformity of concn. between the surface and the mass of the liquid. The theory harmonizes the facts that positively and negatively adsorbed dissolved matter causes foam in liquids and explains why pure liquids do not foam.

ALFRED HIRSCH

The boundary tension: water-butyl alcohol, water-isobutyl alcohol and glycerol-isobutyl alcohol. K. SILBEREISEN. *Z. physik. Chem., Abt. A*, 143, 157-66 (1929).—Mixts. of liquids with low interfacial tension were employed by Bechhold for the measurement of pore size of ultrafilters (*C. A.* 23, 5554). Accurate detns. of this quantity are made by the method of capillary rise. The capillaries (220-mm. long) were calibrated by direct measurement and by Hg wts; the radius was between 0.2 and 0.5 mm. The difference in d , ρ , of the 3 pairs of liquids is given between 1° and 37° . The capillary was mounted inside a Liebig cooler tube for const. temp., 10 min. was allowed each time before the readings were taken. For isobutyl alc.-water the interfacial tension ψ in dynes per cm. (av. of 5 detns.) and the temp. of observation were, resp., 1.61, 3° ; 1.78, 17° ; 1.85, 22° ; 1.86, 27° ; 1.84, 32° ; 1.80, 37° . For butylalc. water 1.605, 4° ; 1.58, 20° ; 1.565, 37° . For isobutyl alc.-glycerol (only smallest capillary could be used) 0.76, 1° ; 0.444, 5° ; 0.190, 13° ; 0.038, 19° . The last liquid combination has the lowest boundary tension found so far.

B. J. C. VAN DER HOEVEN

Dark-field microscopy of monomolecular films. H. ZOCHER AND F. STIEBEL. *Naturwissenschaften* 17, 672-3 (1929).—A no. of substances of fatty and oleic acid series, also proteins, were examd. for their homogeneity in monomolecular film with and without mech. compression. The homogeneity was generally confirmed but a few showed colloidal particles on compression.

B. J. C. VAN DER HOEVEN

Superficial films on water and molecular dimensions. ANDRÉ MARCELIN. *Compt. rend.* 189, 236-8 (1929).—A superficial film is more sol. at high temps. and when its superficial pressure is increased. Because of soly. it is often impossible to measure directly the thickness of a surface film. The length of a mol. can be calcd. from $l = VC/S_sE$, where V is the vol. of a quantity of substance which occupies the surface S_s in the state of max. spreading, E is the coeff. of extension and C the coeff. of reduction of the surface necessary to compress the superficial soln. to satn. Values of l detd. by x ray, by Langmuir and by the above formula, resp., are in A. U.: oleic acid 22, 11.2, 23; myristic acid 16.1, —, 16.1; cetyl alcohol 23.25, —, 13.5; palmitic acid 17.8, 24, 17.7; stearic acid 19.35, 25, 19.4.

E. G. VANDEN BOSCHÉ

Superficial solutions and molecular films. A study of some substances and the determination of the length of their molecules. FAHIR EMIR. *Compt. rend.* 189, 239-40 (1929).—The work of Marcelin (preceding abstr.) is further discussed. Values are given for the const. of the equation for palmitic and stearic acids and for cetyl alc.

E. G. VANDEN BOSCHÉ

The spreading of substances of high molecular weight in very thin films on the surface of water and the value of such films as an investigational method for the form and size of molecules and micelles. J. R. KATZ AND P. J. P. SAMUEL. *Ann.* 472, 241-67 (1929).—By the methods of Langmuir and Adams the area per mol. of esterified cellulose and the thickness of the films formed on water were detd. for various samples of amorphous and cryst. ethylcellulose (I), methylcellulose (II) and di- and tri-acetylcellulose (III) from solns. in PhH, CHCl_3 , $\text{CHCl}_3 + 10\%$ alc. and $\text{CH}_2\text{Cl}_2 + 10\%$ alc. The no. of OH groups per mol. of cellulose which were substituted varied from 2.25-3.0. The areas in sq. A. U. and the thickness in A. U. were for (I) 63.5-66, 5.2-5.5; (II) 59-61, 4.1-4.3; (III) 34-40, 8.2-8.8. The thickness of the films corresponds with those of ordinary org. mols. The values for the amorphous technical and the cryst. products agree remarkably well. The marked difference in area and thickness of film for alkyl- and acetyl-celluloses are attributed to difference in orientation of the mols. in the surface. A comparison of films produced by cellulose trilaurate (IV) and tristearate (V) from PhH,

shows that they are analogous to those produced by the corresponding triglyceryl esters. Area and thickness in the usual units are, resp., (IV) 107 $\frac{1}{2}$, 11.4; (V) 69, 22.2. Using various specimens of acetates of starch, inulin, lichenin and glycogen the authors found that the areas and thicknesses correspond with those of the cellulose acetates in all cases except glycogen acetate where the thickness was 14.5–15.7 A. U. The fact that the thickness of film was independent of viscosity and was the same for the amorphous and cryst. preps. seems to indicate that the micelles of these substances have a thickness of 1–2 C chains. A diagram and detailed description of the app. and its manipulation are given.

E. R. SCHIERZ

Superficial solutions of oleic acid. Measurement of very low pressures. JEAN GUASTALLA. *Compt. rend.* 189, 241–3 (1929).—Superficial pressures of solns. of oleic acid were measured with the app. described by Marcelin (*C. A.* 20, 855). Solns. with one mol. on an area of 45 sq. A. U. to 30,000 sq. A. U. were studied. There is a rapid decrease in pressure at first; then between 500 and 5000 sq. A. U. the decrease is not so great (p for 5000 sq. A. U. is 0.058 dyne/cm.); and above this area the pressure decreases rapidly again.

E. G. VANDEN BOSCHE

Theory of gas adsorption. A. MAGNUS. *Z. physik. Chem., Abt. A*, 142, 401–30 (1929).—A complete theory of gas adsorption is advanced, based upon the hypothesis that gas mols. are held to a surface by means of electrostatic forces acting between the natural or induced dipoles of the gaseous mols. and the adsorbing surface. Application of the theory to the calcn. of the variation with temp. of the adsorption of CO₂ on SiO₂ gel and on charcoal leads to calcd. values for the heat of adsorption that are in good agreement with the exptl. ones. By adopting the Volmer viewpoint of considering an adsorbed gas as a two-dimensional phase, and modifying the resulting equations to conform with the electrostatic dipole theory, M. succeeds in calcg. a series of isotherms for the adsorption of CO₂ on C that agree well with the exptl. curves. Over a wide range of pressure the calcd. isotherm for the adsorption of CH₄ on glass approximates closely the exptl. data of Zeise. A semi-quant. deduction of the variation with pressure of the heat of adsorption of a gas on a solid agrees qual. with the observed data.

P. H. E.

Sorption of gas by porous matter. JITSUSABURO SAMESHIMA. *Bull. Chem. Soc. Japan* 4, 125 8; *Chem. News* 139, 61 2 (1929).—After measuring the amts. sorbed by various charcoals and the sorption velocity of CO₂ by sugar charcoal it is concluded that sorption is a process of soln., not one of adsorption. Porous substances are assumed to have many cavities of mol. size, which gas mols. fill, making a homogeneous solid soln. This conception explains the ease of sorption of condensable gases, the expansion of charcoals and deviations from Henry's law.

MARY E. LEAR

The surface tension and the stability of colloidal solutions. G. ROSSI AND A. MARESCOTTI. *Gazz. chim. ital.* 59, 313 9 (1929).—Instead of following previous methods for studying the relations between the surface tension and stability of colloidal solns., *i. e.*, by addn. of a substance capable of diminishing the surface tension to a colloidal soln., a powerful stabilizing agent, *viz.*, gelatin, was added to colloidal As₂S₃ soln. and the variations in surface tension as a function of the concn. of the gelatin were detd. The gelatin increased enormously the stability of the As₂S₃ toward the coagulating action of HCl, *e. g.*, to coagulate 300 cc. of a soln. contg. 0.2872 g. of As₂S₃ only 12.87 millimol. of HCl was necessary, but with the addn. of 12 g. of gelatin 300 millimol. of HCl was necessary. In spite of this, gelatin did not diminish the surface tension of the soln. below that of water. There was no relation found between surface tension and stability, and contrary to general belief a substance with the power of lowering the surface tension of water can increase the surface tension and stabilize a colloidal soln. Added to a colloidal Fe(OH)₃ soln., gelatin did not increase the stability but, according to the ratio of the concn. of Fe(OH)₃ and of gelatin, increased or diminished the surface tension of the colloidal soln. The stabilization of colloidal solns. is much more complicated than assumed by some, for it depends upon the formation of mixed particles from the union of suspensoids and emulsoids (*cf.* R. and Cecchetti, *C. A.* 20, 1933) but having the stability of each. The surface energy, *i. e.*, the surface tension, of the particles is the destabilizing factor in the system, and with invariable stabilizing influences it renders the soln. the more and more unstable the greater its magnitude. This surface energy must not be confused with the surface tensions as measured by immersing a capillary in the soln. and detg. the height or by the no. of drops per unit vol. from a stalagmometer. Such measurements do not represent and do not even bear any relation to the surface energy of the particles. The present expts. demonstrate this completely.

C. C. D.

The coagulation of colloidal solutions. G. ROSSI AND A. MARESCOTTI. *Gazz. chim. ital.* 59, 319–30 (1929); *cf.* preceding abstract.—Expts. show that, contrary to the behavior of colloidal solns. of Fe(OH)₃, diln. of colloidal As₂S₃ solns. increases greatly the

degree of dispersion of the As_2S_3 . As a consequence of this, the ratio between the concn. of a colloid and the quantity of an electrolyte necessary to bring about the sepn. of the colloiddally dissolved substance increases with the diln. to a greater extent with As_2S_3 than with $Fe(OH)_3$. It was found that the rule which states that the quantity of electrolyte necessary to coagulate a colloidal suspensoid varies directly with the concn. of the latter was not valid with As_2S_3 . This exception to the rule depends in all probability upon the great increase in the degree of dispersion which the As_2S_3 undergoes when it is dild. Therefore, at least within certain limits, the value of the ratio between concn. of the colloid and the quantity of electrolyte necessary for coagulation can throw light on the variations in the degree of dispersion which occur when a colloid is dild. C. C. DAVIS

A rapid method for determining the maximum absorptive power of active carbon. H. BURSTIN AND J. WINKLER. *Brennstoff-Chem.* 10, 121-4(1929).—See C. A. 23, 3613.

J. D. DAVIS

Adsorption and solution volume. A. RABINERSON. *Kolloid-Z.* 48, 231-7(1929).—The adsorption of acetic and succinic acids on wood charcoal was studied. For a const. initial concn. of acid and the same quantity of adsorbent the curve for adsorption and soln. vol. is convex to the latter axis. An empirical equation of the exponential type is obtained. The exponent so obtained is not identical with that in the general adsorption equation. A discussion follows of abnormalities observed at the extremes of the various curves obtained. Some data are also given for adsorption of HCl. R. H. LAMBERT

The adsorption of mercury vapor by activated charcoal. D. O. SHIELDS. *J. Phys. Chem.* 33, 1398-1402(1929).—The adsorption of Hg vapor by activated charcoal at room temp. is approx. 0.2 mg. per g. of charcoal. The presence of air in the charcoal does not increase the sorptive capacity for Hg. P. H. EMMETT

The sorption of sulfur dioxide, carbon dioxide and nitrous oxide by activated carbon. D. O. SHIELDS. *J. Phys. Chem.* 33, 1386-97(1929).—The adsorption of CO_2 , N_2O and SO_2 by German activated gas-mask charcoal at 25° and at pressures as high as 40 mm. of Hg was detd. The adsorption process is reversible only in the case of CO_2 ; distinct hysteresis occurring with both N_2O and SO_2 . The adsorption of N_2O and CO_2 may be represented by Patrick's equation $V = K(p/P)^{1/n}$, where p is the observed equl. pressure during adsorption, V is the vol. of the adsorbed gas when condensed to the liquid phase and P the vapor pressure of the condensed phase at 25° . P. H. EMMETT

The validity of Stokes' law for non-spherical particles. A. H. M. ANDREASEN. *Kolloid-Z.* 48, 175-9(1929).—The sedimentation of flint particles in water was studied. The app. used is described together with the method of removing samples of the material from the settling chamber at definite times. The actual size-frequency distribution data were obtained by use of the microscope and planimeter. From wt. data and Stokes' law the values for grain size obtained agree within the limits of error of measurements with those obtained photomicrographically, thus verifying the assumption that Stokes' law holds for non-spherical particles. R. H. LAMBERT

Diffusion rings. G. LINCK. *Chem. Erde* 4, 88-94(1928). Microscopic observations on the diffusion of $AgNO_3$ and K_2CrO_4 solns. in gelatin were made. B. C. A.

Theories of Liesegang rings and periodic precipitation. N. R. DHAR AND A. C. CHATTERJI. *Chemistry Industry* 48, 878-80(1929).—The adsorption theory of D. and C. (cf. C. A. 21, 1043) is fundamentally different from that of Bradford (cf. C. A. 23, 2630). F. E. BROWN

Hygroscopic properties of glass. N. A. SHISHAKOV. *J. Applied Phys. Moscow* 4, 37-46(1927) (in Russian with English summary); *Physik. Ber.* 9, 13-4. —The adsorption of H_2O on glass surfaces is studied. The adsorption velocity is much slower with a glass surface covered by an alk. film than with a clean surface. The amt. of H_2O adsorbed increases when the alk. film is removed. To obtain a perfect vacuum, the following details are recommended: use a glass container which has been blown with a compressor, immediately evacuated and sealed. Glass vessels for high vacuum should not stay exposed to atm. air for a long period of time. For quick removal of adhering gases, boiling acid water is recommended. Glass dust treated for a short time at $250-300^\circ$ with acid vapors and steam is an excellent agent for H_2O adsorption even at room temp. ALBERT L. HENNE

Adsorption hysteresis. ALEXANDER R. URQUHART. *J. Textile Inst.* 20, 117-24T (1929).—It has been shown by McGavack and Patrick (C. A. 14, 1776) that the apparent hysteresis in some gaseous adsorptions, e. g., SO_2 on SiO_2 gel at 25° , is due to expl. error. Air held by the adsorbent is displaced by the adsorbed gas and increases the observed pressure in the app. This explanation does not account satisfactorily for all cases of hysteresis recorded in the literature and it is now shown experimentally that there is marked hysteresis in the adsorption of H_2O by SiO_2 gel at 25° even though all air is

carefully removed from the system. It is suggested that the observed hysteresis is real when the adsorption isotherm is S-shaped, especially when there is a strictly reversible region at the lowest pressures, and that such phenomena are encountered when the adsorption takes place at temps. well below the b. p. of the vapor adsorbed but not at temps. well above the b. p.

F. L. BROWNE

The mechanism of the adsorption of water by cotton. ALEXANDER R. URQUHART. *J. Textile Inst.* 20, 125-32T (1929).—Since cotton is an elastic rather than an inelastic gel, the hysteresis in its adsorption isotherm for H_2O cannot be accounted for by Zsigmondy's theory of curvature of the liquid meniscus in capillary spaces. The theory is advanced that adsorption of H_2O takes place at the OH groups of the long, spiral, somewhat flexible mols. of cellulose and that on drying there is a tendency for twisting and rearrangement of the mols. or micelles so that the residual valences of the OH groups mutually satisfy each other, thereby reducing the hygroscopicity. During reabsorption there is a tendency to return to the original orientation, the reproducibility of the hysteresis loop being thereby explained. In the formation of the cotton hair the cellulose is pptd. in the presence of H_2O and the cotton as it is taken from the boll is in consequence exceptionally active; the first drying produces a permanent reduction in hygroscopicity. Thereafter drying and reabsorption curves are reproducible. Heating cotton in a dry atm. reduces the hygroscopicity by favoring the mutual satisfaction of the residual valencies of the OH groups; heating in the presence of H_2O increases the hygroscopicity by releasing the OH groups from each other's influence.

F. L. BROWNE

A two-phase theory of the absorption of water vapor by cotton cellulose. F. T. PEIRCE. *J. Textile Inst.* 20, 133-50T (1929).—It is assumed that there are 2 distinct ways or phases in which H_2O mols. are held in cotton cellulose, the *a* phase in which 1 H_2O mol. is definitely assocd. with 1 hexose unit as in a chem. compd. and the *b* phase in which the H_2O mols. fill the spaces available under attractive forces like those in a liquid. It is the *a* H_2O that influences such properties as strength, elasticity, rigidity, swelling and evolution of heat, while the *b* H_2O supplies the necessary moisture for chem. reactions, growth of organisms and vapor pressure. By assuming that, during absorption, the fraction of the total H_2O taken up that goes into the *a* phase is proportional to the ratio of unoccupied *a* positions to total *a* positions, it is shown that $C_a = 1 - e^{-\alpha C}$, where *C* is the no. of mols. of total H_2O per hexose unit and C_a the no. of mols. of *a* H_2O per hexose unit. Expt. indicates that *q*, a const. of the dynamic equil. between the *a* and *b* phases, is close to 1. It is thus possible to divide the observed absorption of H_2O by cotton into the *a* and *b* phases. The S-shaped relation between rigidity and humidity reduces to a linear relation with the *a* H_2O and the vapor pressure becomes a simpler relation with the *b* H_2O . By equating the evapn. of *b* mols. with the condensation from the atm. a simple exponential relation is obtained which fits the isotherm for starch with one const. only. A minor correction for the evapn. of *a* H_2O allows satisfactory agreement with observed curves for all kinds of cotton. From each curve are obtained a const., β , which is a measure of the openness of the structure and of swelling and a const., *k*, which measures the strength of the hydration bond and the effect of temp. Consideration of β values leads to a picture of the hair wall as composed of very fine spirals, probably only 2 hexose groups thick, in themselves cryst. and elastic. Absorption, swelling, mercerization or esterification opens up the spaces and weakens the cohesion between these elements without affecting their internal structure or strength. In dry, unswollen cotton, the packing is very close and regular, with little free space; in starch about $1/10$ the space is vacant. The rate of evapn. of *a* mols. is to that of *b* mols. as k/β ; this ratio should, therefore, be const. at any temp. and is found to be so. By treating the hydration as a chem. reaction, the effect of temp. on the evapn. of *a* H_2O is deduced and found to agree with observation. Since the relation of *k* to β is known, the theory gives a unique curve detd. by one const. for the isotherm of cotton in any degree of dispersion. This can be fitted by an observation of partial pressure at one region only, and satisfactory agreement is obtained with observed isotherms.

F. L. BROWNE

The emanation method for chemical and physical chemical research. OTTO HAHN. *Naturwissenschaften* 17, 295-6 (1929).—A short review of the possibilities of the emanation method in the study of the surface properties of various substances. For non-radioactive substances adsorption or homogeneous distribution of active material in the substance is advocated. Metal oxide gels have been studied in this manner for their aging behavior, shrinkage, etc. (cf. *C. A.* 23, 2087). Several references are given.

B. J. C. VAN DER HORVEN

Adsorption phenomena in solutions. XVIII. Gas-free charcoal as adsorbent. NIKOLAI SHILOV and KONSTANTIN CHMUTOV. *Z. physik. Chem.*, Abt. A, 143, 41-54 (1929); cf. *C. A.* 22, 4302.—Charcoal outgassed at high temp. and low pressure will

adsorb CO_2 and HCl but not neutral KCl from solns. A small O_2 pressure admitted to C before wetting with neutral KCl gives high p_H attributed to HCO_3^- formed and adsorbed.

GUY B. TAYLOR

Adsorption (and absorption) and elutriation experiments of solids with iodine. K. SCHARRER AND J. SCHWAIBOLD. *Z. anorg. allgem. Chem.* **182**, 193-206(1929).—Earths of a varied character were treated with solns. of I^- , IO_3^- , IO_4^- and I_2 , and the absorptive and adsorptive properties studied. Prolonged washing removed only a portion of the adsorbate. Solids from bogs showed greatest absorption, the adsorption decreasing with the amt. of colloidal matter. The absorption series is $\text{IO}_4^- > \text{IO}_3^- > \text{I}^-$. The cation was found to influence the absorption of the salts

S. LENHIER

A study of the emulsifying properties of certain salts of arabic acid. J. C. KRANTZ, JR. AND NEIL E. GORDON. *J. Am. Pharm. Assoc.* **18**, 463-8(1929).—Arabic acid was prepd. from acacia and the Mg , Na , Fe and Pb salts were prepd.; also the Na , Mg , Zn and NH_4 salts of valeric acid, likewise Ca gluconate, Cd i -galactonate and Mg dihydroxystearate. Emulsions of mineral oil were prepd. with these salts, a few other salts and H_2O . The emulsions were studied with respect to whether they belonged to the oil-in- H_2O type, the H_2O -in-oil type or the amphoteric type. Their stability and phys. properties were also observed. The oil-in- H_2O type was formed with Na oleate, arabic acid, the arabates of Na , Mg and Fe , and the valerates of Na and NH_4 , Na gluconate, Na i -galactonate, Na dihydroxystearate, Na salicylate and Na gallate. Emulsions of the H_2O -in-oil type were formed with oleates of Mg , Ca , Co , Ni , Mn and Al , the valerates of Mg and Zn and Mg dihydroxystearate. Amphoteric preps were given with Ca gluconate Cd i -galactonate, Ca salicylate and Ca gallate. Pb arabate did not act as an emulsifying agent.

L. E. WARREN

Method of determining the type of an emulsion. J. E. CARLIFE. *Chem. Weekblad* **26**, 413-6(1929).—A method based upon the same principle as the detn. of the n of minerals (Schroeder van der Kolk, Tabellen zur mikroskopischen Bestimmung der Mineralien nach ihrem Brechungsindex, 1906). The emulsion can be used without changes. This prevents any chance of alteration in the type of emulsion as is possible with the other methods. A parallel bundle of light going through a drop of oil in water will be converged, because the n of oil is greater than that of water. With a drop of water in oil the bundle will be diverged. Illuminating with a parallel bundle from the right, with oil in water, will give a bundle of which the rays from the left will come into the objective and those from the right will be invisible. In the microscope one will see an illuminated border on the right side of the drop whereas the other side looks dark. A drop of water in oil will show the opposite. Instead of producing a bundle from one side, one can insert a diaphragm in the shape of a half moon between the concave mirror and the condenser of the microscope.

E. SCHOTTE

X-ray studies of particle size in silica. R. H. ABORN AND R. L. DAVIDSON. *J. Franklin Inst.* **208**, 59-71(1929).—Powdered SiO_2 specimens, very carefully classified for size and ranging in av. size from 1.73 to 36.0μ , were exam'd by the powder diffraction method, with unfiltered radiation from a Coolidge Mo target. Qual. differences were observed in the diffraction patterns: (a) With varying av. particle size and the same size distribution, (b) with varying size distribution and the same av. particle size. Microphotometric analysis of the patterns indicates that a quant. relationship between pattern characteristics and av. particle size can be obtained only if the size distribution is kept const.

C. J. HUMPHREYS

Spontaneous formation of crystal nuclei in dilute, highly supersaturated gold solutions. P. A. THIESSEN. *Z. anorg. allgem. Chem.* **180**, 57-64(1929). Dil. supersatd. Au solns. were prepd. by reduction of a Au salt. By ultramicroscopic examn., the no. of crystal nuclei were counted. The spontaneous nucleus formation is discussed. After a short induction period, the no. of nuclei increases proportionally to the time; it decreases when the supply of Au nears exhaustion. The above results were used to prep. Au hydrosols of definite particle size without addn. of nuclei.

Smallest crystal nuclei in highly supersaturated gold solutions. P. A. THIESSEN. *Z. anorg. allgem. Chem.* **180**, 110-4(1929).—The dimension of the smallest particle of Au capable of acting as a crystal nucleus is about 10^{-7} cm. The exptl. detn. and computation agree satisfactorily.

ALBERT L. HENNE

Gold hydrosols having graded numbers of particles, produced without addition of nuclei. P. A. THIESSEN. *Kolloidchem. Beihefte* **29**, 122-46(1929). Au sols contg. varied nos. of particles were prepd. A soln. of HAuCl_4 was dild. and treated after a definite interval with a reducing agent which caused the formation of nuclei. After another fixed interval, a 2nd reducing agent was added which caused growth of the particles but suppressed further formation of nuclei. The sol was made faintly alk.

with Na_2CO_3 before or after the addn. of the first reducing agent. The no. of particles was counted with the aid of a slit ultramicroscope. Agents which aided the spontaneous formation of nuclei were $(\text{CO}_2\text{K})_2$, H_2O_2 , CO in acid soln., Na citrate, KCNS and ultra-violet light. The formation of new nuclei was hindered and their growth promoted by the addn. of either $\text{NH}_2\text{OH}\cdot\text{HCl}$ or $\text{N}_2\text{H}_4\cdot\text{H}_2\text{SO}_4$. Hydrolysis of HAuCl_4 decreases the no. of nuclei formed. Increased temp. decreases the speed of formation of nuclei. In general the rate of formation is slow at the start, then is accelerated and finally ceases after several min. contact. HAuCl_4 subjected to ultra-violet light for intervals of time up to 4 hrs. showed a rapid increase in the no. of nuclei formed, followed by a rapid decrease. The max. occurred after about 125 min. With KCNS the no. of nuclei formed is enormously greater than with any of the other agents used. This is due to the property of S compds. of strongly limiting the growth of particles. CORNELIA T. SNELL

A new method of preparation of colloidal gold. M. DOMANITZKII. *Ukrainskii Khim. Zhur.* 4, Sc. Pt., 1-6(1929).—Unsaturated hydrocarbons (amylene, acetylene, diallyl, etc., with double and triple bonds) when acted upon by HAuCl_4 give rise to finely dispersed red, blue and violet sols depending on the concn. of the Au soln. used and purity of water. The following method especially gives a red sol with distinct characteristics: 100 cc. pure water is mixed in a Jena glass flask with 5 cc. soln. of 2 g. $\text{HAuCl}_4\cdot 4\text{H}_2\text{O}$ in 1000 cc. H_2O , 2 cc. 0.2 N Na_2CO_3 and 8-10 drops amylene and heated to boiling. The metal of the sol is not amalgamated in the course of several weeks as the ultramicros of Au are not adsorbed on the surface of Hg; it is, however, adsorbed by fine cryst. gels of BaSO_4 , SrCO_3 , CaCO_3 , $\text{Al}(\text{OH})_3$ and the sol decolorized. On cataphoresis the ultramicros of the sol go to the anode and coagulate; the soln. round the anode becomes blue; they go through the $2\frac{1}{2}$ Schleicher-Schull filter as 0.1% soln. of collargol does. They are, therefore, about 20μ in size. Colloidal solns. of Ag and Pd were prep'd. in a similar way, but Pt gave no sol. JAROSLAV KUČERA

Some experimental results on the production of colloidal gold by means of alkaline formaldehyde solutions. P. P. VON VEIMARN. *Kolloid-Z.* 48, 346-52(1929).—See C. A. 23, 2868 P. H. EMMETT

Particle size and the properties of matter. HARVEY A. NEVILLE. *Chemist-Analyst* 18, No. 5, 4-5(1929).—The particle size is discussed particularly with reference to solv., color and reactivity. Practical applications are illustrated in the manuf. of pigments, baking powders and portland cement. W. T. H.

A special case of syneresis. FRIEDRICH C. JACOBY. *Kolloid-Z.* 48, 171-5(1929).—In the prepn. of dyes gels form on cooling in the vats in which syneresis soon occurs. Its presence can be distinguished by regular contour lines and the great elasticity observed. The resultant product of syneresis is not a homogeneous material but consists of a gelatinous membrane inclosing a sol. Particles of dye in the inner sol are of almost mol dimensions. The concn. of dye is much less in this sol than in the exuded material. A material is added such as Turkey red oil which reduces the syneresis effect. R. H. LAMBERT

The effect on some colloidal chemical properties of kaolin of multivalent cations. I. I. ZHUKOFF AND M. N. SOKOLOVA. *Kolloid-Z.* 48, 71-8(1929).—The adsorption of $\text{Th}(\text{NO}_3)_4$ and FeCl_3 by kaolin was studied. HNO_3 reduces adsorption of the former and HCl of the latter. Kaolins from different sources do not have the same adsorption power. The adsorption theory for coned solns. is not believed to be applicable here, since at the most only 40-50 milliequivalents of Th or Fe salt is present. The hydrolytic theory seems to explain the data more accurately. Cataphoretic and electroendosmotic expts. show a reversal in charge as the concn. increases. The point of reversal is not at the same concn. for the two methods of observing the sign of the charge. The rate of sedimentation of kaolin passes through a min. for concn. of electrolyte while the rate of filtration passes through a max. although not at the same concn. of electrolyte. No explanation of this fact could be found. R. H. LAMBERT

The behavior of swollen gelatin in water vapor. F. H. BUCHNER. *Rec. trav. chim.* 48, 1047-51(1929).—When gelatin is swollen to satn. in 0.01 N NaOH or 0.01 N HCl, 30 to 50 times its wt. of liquid is adsorbed. When such swollen gelatin is exposed to satd. H_2O vapor at the same temp., considerable wt. is lost. This seems to contradict the second law of thermodynamics. This loss is not due to gravitational effects; for swollen gelatin suspended in mixts. of inert org. liquids loses water just as when suspended in the vapor. The effect might be due to change of p_{H} . Gelatin swells in NaOH more rapidly and to a greater final vol. if completely protected from CO_2 of the air. However, direct measurement of freshly swollen samples which had lost water showed no differences in p_{H} great enough to account for the loss of water. Surface forces might be the cause.

Expts. show that the loss of water is more nearly proportional to the surface of the specimen than to its mass. F. E. BROWN

The action of salts of polynuclear bases on colloidal suspensions and on the electrocapillary curve. J. A. V. BUTLER AND W. O. KERMACK. *Proc. Roy. Soc. Edinburgh* 49, 300-12(1929).—Salts of 5,6-benzo-4-carboline and its derivs. ppt. colloidal gum benzoïn in concns. of 0.000012 to 0.00002 *M*. Approx. the same concns. of these salts also ppt. sols of gum mastic, Au, As₂S₃ and CdS, all negatively charged colloids. With higher concns. of the benzocarboline salts, no pptn. occurs but the charge on the particles changes from neg. to pos., as shown by cataphoretic expts. with gum benzoïn. Other substances producing a similar effect include certain dyestuffs, inorg. cations having a valence of 3 or more (C. A. 19, 2435), and proteins on the acid side of the isoelec. point (C. A. 18, 414). Mixts. of benzocarboline salts and gelatin require less of each in the mixt. than of either one alone to ppt. gum benzoïn at *pH* 4.6. At *pH* 7.0 a higher concn. of benzocarboline causes pptn. but the presence of gelatin tends to prevent pptn. The effect of 0.00005 *M* solns. of the benzocarboline salts on the electrocapillary curve of Hg (C. A. 23, 2340) is to lower the max. and to shift it to the right of the max. of the primitive (neg. polarization of the Hg). The greatest fall in surface tension occurs to the left of the max. of the primitive (pos. polarization of the Hg). The results with sols indicate high adsorption of benzocarboline ions on a negatively charged surface. The electrocapillary curves indicate high adsorption even on a positively charged surface.

CORNELIA T. SNELL

The index of refraction of colloidal solutions of sulfur. G. ROSSI AND A. MARESCOTTI. *Gazz. chim. ital.* 59, 309-13(1929).—The expts. had as their object the confirmation or disproof of the discovery of Boutaric and Perreau (cf. C. A. 22, 526) that dispersed particles can increase the *n* value of a soln., and furthermore a study of the influence of the concn. of electrolyte on the *n* value of a soln. contg. a given colloid. A colloidal soln. of S was chosen, because of the readiness with which the concn. of stabilizing agents (H₂SO₄ and Na₂SO₄) and the quantity of dispersed S can be varied and controlled. It was found that dispersed S increases the *n* value to a degree which was proportional to the quantity of S present. Thus 100 cc. of a soln. contg. 2.0852 g. of H₂SO₄ and 2.4408 g. of Na₂SO₄ had a n_D^{25} value of 1.33820, whereas the same soln. contg. 4.1154 g. of dispersed S had a n_D^{25} value of 1.35391. When these solns. were dild. to the same extents, the *n* values changed proportionately, so that in all cases the dispersed S increased the *n* values. In other series, the proportion of S was varied, as a result of which it was found that the increase in the *n* value by the S was directly proportional to the concn. of the S. In general the expts. show that it is impossible to define the properties of colloidal solns. without also defining the nature and the concn. of the electrolytes which are present.

C. C. DAVIS

Chromic oxide hydrate free of electrolytic matter. P. A. THIESSEN AND B. KANDELAKY. *Z. anorg. allgem. Chem.* 182, 425-8(1929).—A hydrogel of Cr₂O₃·3H₂O poor in electrolytes or a neutral hydrosol of this compd. is prepd. by hydrolysis of an alc. soln. of Cr(OC₂H₅)₃. A neutral hydrosol obtained in this manner, contg. a concn. of 0.015% Cr₂O₃, is very stable in absence of electrolytes and has a weakly positive charge. Its particle size varies between 3 and 30μ. H. STOERTZ

Electrodialysis. LÁSZLÓ REINER. *Magyar Chem. Folyóirat* 34, 161-70(1928).—Expts. showed that the charge of membranes plays very little part in electrodialysis. The *pH* should change in the medium chamber even with ideal uncharged membranes. In the electrodialysis of a non-diffusive ampholyte the final reaction is not influenced by charge of membranes and approaches closely the isoelec. point of the ampholyte. Electrodialysis under adequate voltage and c. d. can be so effected as to hold the *pH* always in the range between the initial and final *pH*. A membrane is described which ensures attainment of the isoelec. point at the end of the electrodialysis. This membrane may consist of collodion, which adsorbs the albumin of the material being electrodialyzed and then acts like a membrane of the albumin. Solns. of globulin, egg albumin and sera were electrodialyzed with collodion membranes in a simple app. The end reactions agreed with the isoelec. points of globulin and egg albumin. Finally the use of electrodialysis in industry is described. S. S. DE FINALLY

The peptization of calcined ferric oxides and the formation of a ferric oxide mirror. ALFONS KRAUSE. *Z. anorg. allgem. Chem.* 180, 120-6(1929); cf. C. A. 23, 1074.—After calcination, ferric ferrite is the only ferric oxide which can be peptized with dil. acids. Ortho- or meta-ferric oxides cannot be so peptized. Calcined meta-ferric oxide is the only one to be peptized by dil. NH₄OH. This proves that 3 different types of oxides really exist. The acid peptization gives a positively charged hydrosol, with hydrophobic

character, which is shown by its ability to form mirrors on glass or porcelain surfaces. Meta-*b*-ferric acetate hydrosol is capable of forming mirrors, but to a considerably less extent. Never does ortho-*c*-ferric acetate hydrosol build a mirror. The *a*-, *b*- and *c*-ferric acetate hydrosols are compared, and the stabilizing influence of each one on the others is investigated.

Colloidal ferric oxide without electrolytic impurities. P. A. THIESSEN AND OTTO KOERNER. *Z. anorg. allgem. Chem.* 180, 115-9(1929).—The hydrolysis of pure $\text{Fe}(\text{OEt})_3$ yields a Fe_2O_3 hydrosol free of any impurity of an electrolytic character. This hydrosol is lyophobic and generally behaves like a metal colloid. The Fe_2O_3 particles are charged negatively. The sensitiveness of this sol toward electrolytes is very great. OH ions and FeCl_3 increase its stability. The hydrosols contg. alk. impurities are negatively charged; they are positively charged in the presence of acids or FeCl_3 . The hydrophilic character of Fe_2O_3 hydrosols obtained by peptization or hydrolysis results from their electrolyte content.

ALBERT L. HENNE

Petrography of colloidal solutions of metallic sulfides. PAUL BARY AND JOSÉ V. RUBIO. *Compt. rend.* 189, 294-6(1929).—The authors studied the figures (*petrographs*) obtained by drying colloidal solns. of the sulfides of Sb, As, Hg, Zn, Mo and Cu. A thin narrow plate of glass was partially submerged in a soln. and the soln. evapd. by heating or by exposing to H_2SO_4 *in vacuo*. The deposited figures were then studied. When the solns. are dil. the deposit consists of horizontal bands alternately clear and colored with the characteristic color of the sulfide. In more concd. solns. the bands become lines 6.3-11.6 μ apart. In the case of the CuS suspension the horizontal lines are undulating and are interconnected by other lines to form a network. The deposit is always a gel, sometimes slightly hydrated. These solns., which show only a slight Tyndall effect, are to be considered as aq. solns. of a gel. This liquid gel imprisons and stabilizes granules of unhydrated material making a gel by an action analogous to that of a "protective colloid."

E. R. SCHIERZ

Coagulation and particle size. P. A. THIESSEN, K. L. THATER AND B. KANDELAKY. *Z. anorg. allgem. Chem.* 180, 11-8(1929).—Several Au hydrosols were prepd., similar in every respect but particle size. The effect of the degree of dispersion on the stability was studied by 2 methods: measurement of the coagulation velocity in the presence of equal proportions of the same electrolyte, and detn. of the min. concn. of an electrolyte required to cause a definite decrease in the particle no. Both methods show that the stability is inversely proportional to the particle size. The crit. potential of dispersed substance depends on the particle size.

ALBERT L. HENNE

Coagulation of von Veimarn's Au sol. I. EIICHI IWASE. *Bull. Chem. Soc. Japan* 4, 120-5(1929).—Au sols were prepd. by modification of the CH_2O method with ordinary glass vessels and ordinary distd. water. Coagulation nos. with NaCl are altered very little by varying the conditions of prepn. With KOH sols such variations change the coagulation values considerably; changes with BaCl_2 are very great. The KOH sols preserve their pure red color with BaCl_2 . The darker the red and the stronger the opalescence, the less the coagulation value.

MARY E. LEAR

The inhibitory action of starch upon the velocity of coagulation of goethite sols by means of electrolytes. H. FREUNDLICH AND B. S. GREENSFELDER. *Kolloid-Z.* 48, 318-25. —The $\text{FeO}(\text{OH})$ sols (goethite sols) were prepd. from $\text{Fe}(\text{CO})_5$. The velocity of coagulation by Na_2SO_4 was followed by titration of the solns. remaining after sepg. the ppt. by centrifuging. Small addns. of starch have little influence on the velocity of coagulation; further addns. cause the velocity to pass through a max. and then fall off. The results suggest that a layer of starch of definite thickness may form upon the particles of the $\text{FeO}(\text{OH})$ sol. After the layer has been completed, further increase in thickness has little influence on the properties of the sol. The influence of the starch is not reversible and is only slightly affected by diln. The complicated relation between coagulation velocity and starch content makes it impossible to compare accurately the coagulation velocities in starch-free sols and in starch-contg. sols. A high electrolyte concn. and a high starch concn. act to peptize the goethite sol, a phenomenon similar to the effect of high electrolyte concn. upon a Graham iron oxide sol. contg. albumin. In this case the question is wholly one of the peptization of the hydrophilic colloids by means of the electrolyte. It is only in starch-free sols that high electrolyte concn. produces a high coagulation velocity.

L. L. QUILL

Periodic structures from interacting gases. ERNEST S. HEDGES. *J. Chem. Soc.* 1929, 1848-9.—The formation of Liesegang rings from HCl and NH_3 was observed under careful drying and temp. control. It is shown that moisture plays no significant part and that Ostwald's "diffusion wave" theory (cf. *C. A.* 19, 3482) is not applicable.

GREGG M. EVANS

Kolloid-Z. **49**, 16-35(1929).—The explanation of abnormal features in the soly. of globulins and other proteins based mainly on chem. and physicochem. considerations according to Sørensen, (cf. *C. A.* **19**, 2832), is compared with the one preferred by Wo. Ostwald, (cf. *C. A.* **22**, 897), whose point of view is chiefly colloidchem. and regards these processes of soln. as typical peptization. The "solid-phase rule" (cf. *C. A.* **22**, 4308) is applied to the pptn. of ordinary *d*-tartaric acid by *N* NaOH and it is shown that this rule is not peculiar to colloidchem. peptizations and characteristic of them as distinct from purely chem. processes of soln. An investigation by von Buzágh (cf. *C. A.* **22**, 4310) is subjected to crit. examn. and a series of soly. expts. of casein in weak NaOH solns. is reported. With const. NaCl concn. and const. amt. of NaOH, increasing quantities of casein will result in the soln. of greater quantities of casein, as long as the quantity of casein is not disproportionate to that of NaOH. The quantity of casein dissolved with the same amt. of NaOH, expressed in % (*Q*) of the total quantity of casein (*Z*) decreases with increasing values for *Z*, and this in such a manner that *Q* and the *pH* vary regularly in all series of expts. With const. salt concn. and const. quantity of casein, increasing quantities of soda increase the amt. of casein dissolved. The distribution of the NaOH between soln. and ppt. is such that the abs. quantity of surplus NaOH remaining in soln. increases with increasing quantities of NaOH employed, and this to a greater extent than the quantity of casein dissolved. Under otherwise equal conditions, an increase in the salt concn. will increase the soly. of casein in weak NaOH solns. (cf. *C. A.* **20**, 1934). The addn. of NaCl displaces the isoelec. point for casein in the acid direction. The increase in the soly. of casein in weak NaOH solns. on addn. of NaCl becomes more pronounced with increasing concn. of salt, until the soln. is about twice the normal. Further increase in the concn. of salt reduces the soly. of the casein once more, compds. being probably formed between the casein and the salt or one of the latter's ions. E. SCHOTTE

Dielectric polarization of ovalbumin solutions. MILLE Y. GARREAU AND N. MARINESCO. *Compt. rend.* **189**, 331-3(1929).—The dielec. consts. of solns. of ovalbumin at *pH* 3 to 10 at 20° are greater than that of water. An anomaly is observed at the isoelec. point that is thought to be due to the amphoteric and hydrophilic nature of the ovalbumin. Neutral salts cause a lowering of the dielec. const. on the acid side of the isoelec. point but they are without visible effect on the alk. side. F. W. LAIRD

Membrane potentials. JOHN M. ORT AND W. G. FRANCE. *J. Phys. Chem.* **33**, 1374-85(1929).—The sp. charge on membranes in a Des Coudres cell was found to exist even in the absence of pressure and caused the readings of cell potentials to differ from values calcd. by Des Coudres' equation. The cell potentials were the algebraic sum of the sp. charges and the calcd. values. Higher temp. makes the charge more neg.; higher concn. more pos. The effects due to the nature of the membrane and the time of exposure to the electrolyte were studied. Sp. charge means the indirect effect on measured potential by actual *p. d.* between membrane and electrolyte due to the action of the elec. field around the charged double layer at the contact surface of electrolyte and membrane. MARY E. LEAR

Organogels. Contribution to the study of lyophilic colloids. ETTORE DA FANO. *Giorn. chim. ind. applicata* **11**, 199-203(1929).—Many Na and K soaps when heated will disperse, forming gels on cooling. Many gels not previously known have been prepd. The fatty acids, even as low as propionic, act as protective colloids, rendering possible the dispersion of formates, acetates, propionates, butyrate, valerate, etc., which had not previously been prepd. By using ricinoleic acid, gels were prepd. even in such a medium as coal-tar. A. W. CONTIERI

Studies on some organic jellies. ETTORE DA FANO. *Ind. del min. e grassi* **9**, 105-8(1929).—Jellies were prepd. by dispersing palmitates, stearates, oleates, ricinoleates, and linoleates in mineral oils, paraffin, vaseline, petroleum, resin oils, olive oils, tetrahydronaphthalene, decahydronaphthalene, pentachloroethane and hexachloroethane. No jellies resulted with resin soaps and dense mineral oils or some vegetable oils. For gelatinizing, the dispersing means was heated with soap at a temp. where it dissolved in appreciable amt. On cooling a very soft jelly resulted which became firmer at a lower temp., the firmness depending upon the products used and the amt. of soap dissolved. By cooling a mixt. with paraffin the jelly became solid, and on warming with care a jelly was first produced and then a liquid showing no change in structure. Addns. of 1-2% of certain products changed the aspect and properties of the jellies. The mixts. were compared with respect to the temps. at which they formed a uniform mass by heating slowly in a beater, stirring, and testing at intervals of temp., at first at intervals of 5°

and then of 2°. The test was made by placing a drop on a cold glass plate and noting whether the components sepd. The temp. where the mixt. was uniform was recorded provided it was attained before 200°, at which the substances decompd. At the temp. of full soln. the flame was taken away, the mixt. left to cool and the temp. of solidification to a coherent jelly observed. An elec. thermostat was used to det. the 3 temps. exactly. The fatty acids acted as protective colloids, aiding the dispersion and jelly formation and reducing the 3 temps. Too great an addn. stopped all gelatinizing. Fatty acids permitted dispersion of soaps in org. solvents that otherwise would not disperse, and jellies could be formed of formates, acetates, propionates, butyrates, valerates and isovalerates, in hydrocarbons and dense and fluid mineral oils, tars and bitumen.

R. SANSONE

Gels. A study of the gels obtained with the salts of quinine, optochine and eucupine. PIERRE THOMAS AND Mlle. MARIE SIBL. *Compt. rend.* 189, 292-4(1929).—The phenomena previously reported (cf. *C. A.* 22, 10) for acetal of sorbitol are also shown by Li urate. With Rona's method gels were prepd. by the addn. of Na_2SO_4 to hydrochlorides of quinine (I), optochine (II) and $\text{CH}_3\text{CO}_2\text{Na}$ to eucupine HCl (III) (isoamylhydrocupreine). I crystd. after 10-15 min. in fine, long needles, sometimes curved, which retain much H_2O by capillarity. Upon vigorous shaking a liquid forms with no visible crystals. With II a gel forms which crystd. only after several hrs. in fine hair-like crystals. With III a gel forms which is stable for several months. Upon covering with a solvent, long hair-like crystals form at the surface of contact, but do not grow into the mass. In every case gentle heating after crystn. sufficed to rupture the gel and form a homogeneous mixt. Upon cooling a transparent gel formed again. The mean diams. of the crystals of Na oleate, Li urate, benzoic acetal of sorbitol, and eucupine acetate lie between 1 and 3μ . There appears to be no relation between mol. structure and the formation of the peculiar crystals observed, but a close relation between this crystal formation and reversible gel formation.

E. R. SCHIERZ

Relations of the solid phase in swelling. WOLFGANG OSTWALD AND PAUL P. KESTENBAUM. *Kolloidchem. Beihfte* 29, 1-79(1929). cf. *C. A.* 22, 4314.—The ratio of the height of a column of the swollen material, or the wt. of the swollen material, to the wt. of original dry material at the end of a definite time interval is the sp. swelling. This increases with temp. The usual "solid-phase effect" consists of a decrease in the sp. swelling with an increase in the amt. of the original material swollen, other conditions being const. Swelling was influenced in various ways by introducing Na_2SO_4 , CaSO_4 , MgSO_4 , $(\text{NH}_4)_2\text{SO}_4$, HCl, picric acid, thiosalicic acid, the decompn. products of gelatin and tannin into the swelling liquid. Materials present in the gelatin itself may diffuse into the swelling liquid and modify the degree of swelling. With 0.16, 0.2 and 0.25 *N* thiosalicic acid, and 0.0003 and 0.0005 *N* HCl, a complete inversion of the "solid-phase effect" occurred in that the largest wt. of material swollen showed the greatest sp. swelling. The sp. swelling plotted against concn. of swelling liquid passes through a min. with HCl present and a max. with picric acid. The swelling of gelatin sols in collodion sacs showed an analogous effect, as successive changes of the water outside resulted in new maxima in the observed height of the column of liquid. The viscosity of the sol was greatly increased by this treatment. Swelling of gelatin in pure H_2O follows the Kroecker adsorption curve. The usual exponential adsorption equation may also be applied. The "solid-phase effect" disappears when salt-free gelatin is swollen. The effect of a substance which increases the sp. swelling such as HCl, may be counterbalanced by that of a substance which decreases the sp. swelling, such as CaSO_4 . Differences in sp. swelling with the wt. of the substance swollen are attributed to differences in concn. of the materials dissolved in the swelling liquid. These materials may be impurities or decompn. products which sep. from the gelatin. If materials are introduced into the swelling liquid, they will be removed from it by the gelatin in different degrees, according to the nature of the material, and amt. of gelatin present. 77 tables of results.

CORNELIA T. SNELL

Solution of metals in fused salts. II. W. EITEL AND B. LANGE. *Z. anorg. allgem. Chem.* 178, 108-12(1929); cf. *C. A.* 23, 16.—From thermodynamical considerations based on the work of Lorenz and Adler (*C. A.* 23, 2627) and from their own expts. E. and L. show that the soln. of Pb and Cd in their resp. fused chlorides is a chem. process involving the formation of a lower chloride. The reaction is reversible, the metal being pptd. in a highly dispersed, colloidal form when the fused mass solidifies.

B. C. A.

Solubilities of potassium chloride, potassium bromide and potassium iodide in alcohols and their mixture with water. S. M. TZEITLIN. *Ukrainskii Khim. Zhur.* 1, Sci. Pt., 580-4(1925).—The best data collected by Herz and Anders (*C. A.* 1, 955, 2856) and

Bodländer (*Z. phys. Chem.* 17, 316(1891)) are used for plotting the curves for solubilities of KCl, KBr and KI in MeOH and EtOH of various concns. at 10.2–19.9°. It can be seen that their course is quite regular after passing the sharpest curves, which explains some exceptions such as the greater soly. of KI in 100% MeOH at 10.2° than at 19.9°.

JAROSLAV KUČERA

Theory of extraction based on the distribution law for solutions. RAOUL FISCHER. *Z. tech. Physik* 10, 153–60(1929).—Extn. processes are considered on the basis of Henry's law. Simple equations are derived for the amt. extd. as a function of concn., vol. ratio, etc., either for single extn., repeated extn. with small quantities or continuous extn. The results are discussed and illustrated in graphs and examples. B. J. C. v. D. H.

Chemical antagonism of ions. IV. Effect of salt mixtures on glycine activity. HENRY S. SIMMS. *J. Gen. Physiol.* 12, 783–92(1929); cf. *C. A.* 23, 4610.—0.01 *M* glycine soln., half neutralized with NaOH, has a p_H of 9.685 which is lowered by the addn. of NaCl, KCl, $MgCl_2$ or $CaCl_2$. If a given amt. of KCl is added to a glycine soln. and then NaCl is added in increasing amts. the p_H is first raised, then lowered and finally raised again slightly. A similar type of curve is obtained by adding NaCl to glycine soln., contg. $MgCl_2$ or $CaCl_2$ and by adding $CaCl_2$ to a glycine soln. contg. $MgCl_2$. The effects appear to be a function of the ionic strength of the added salt. They are almost identical with those produced by the same salts on the p_H of gelatin solns. They are suggestive of physiol. antagonisms but cannot be attributed to colloidal phenomena. C. H. R.

The relation between the sizes of ions and the salting-out of hydroquinone and quinone. K. LINDERSTRØM-LANG. *Compt. rend. trav. lab. Carlsberg* 17, No. 13, 6 pp. (1929); cf. *C. A.* 18, 1415.—The detn. of the activity const. of hydroquinone and quinone in $(NH_4)_2SO_4$ solns. (*C. A.* 20, 1193) has shown that the effect of the NH_4 ion is very nearly the same as that of the Rb ion. The ionic refractivity is of the same magnitude as that of the Rb ion. The effect of substituted NH_4 ions was further investigated. The activity const. of hydroquinone decreases regularly with increasing magnitude of the cation of the salt, while the activity of the quinone is hardly altered. The addn. of 1-g. mol., e. g., of $(C_2H_5)_4NCl$ to 1 l. of satd. soln. of hydroquinone causes a further 1.3-g. mol. to dissolve. The detns. are of interest in their relation to enzymic problems. An important property of an enzyme is its strong affinity for its substrate and slight affinity for the reaction product. If an oxidation enzyme is imagined which catalyzes a reaction between hydroquinone and some O donator with formation of quinone, then the presence of $(C_2H_5)_4NCl$ within the enzyme mol. would afford a likely explanation of the affinities.

E. SCHOTTE

The dependence of equivalent refractivity on the concentration of strong electrolytes in solution. W. GEFFCKEN. *Z. physik. Chem., Abt. B*, 5, 81–123(1929).—The value for the equiv. refractivity of a dissolved substance takes the form $R = \text{const.} (\phi + \pi)$, where ϕ is a single function only of the d and concn. of the soln. and π is a function of the n and concn. $G.$ shows that one can compute the d by means of a graphic representation of ϕ in relation to concn. and conversely the concn. from d . with an accuracy of 0.1% for the d . and 1% for the concn. These relationships constitute a convenient control for measurements of d . and n . A convenient app. for the electrolytic prepn. of NaI by electrolysis of $NaIO_3$ is described. Measurements made of KF, NaCl, KCl, RbCl, CsCl, NH_4Cl , NaI, $NaNO_3$, KNO_3 , $ZnSO_4$, $LiClO_4$, $Al(ClO_4)_3$, $Hg(ClO_4)_2$, $HgCl_2$ and $HgBr_2$ indicated that the equiv. refractivities follow much the same course as similar measurements on other salts by Kohlner (*C. A.* 23, 2091). The extrapolated equiv. refractivities at infinite diln. give values within the exptl. error. L. T. F.

The velocity of diffusion of water through a semipermeable membrane. SAT YENDRA RAY. *Z. anorg. allgem. Chem.* 182, 351–2(1929).—A theory of osmotic pressure is advanced which considers that mols. of a dissolved substance have a charge opposite to that of the solvent, and accordingly tend to draw the solvent through the membrane while the membrane opposes this action.

S. LENNER

Osmosis in ternary liquids through a membrane permeable for two of the three substances. F. A. H. SCHREINMAKERS. *Rec. trav. chim.* 48, 926–30(1929); cf. *C. A.* 22, 4041; 23, 3847.—A continuation of the series on osmosis, giving a math. basis for the conditions encountered.

H. W. LEAHY

The failure of Ohm's law in alternating-current circuits including capacity and resistance. MAHMUDUL H. AHMADI AND HARDIVARI I. TANDON. *Z. Elektrochem.* 35, 471–3(1929).—Ray has criticized the application of Ohm's and Kirchhoff's laws to a. c. in electrolytes (cf. *C. A.* 23, 3403). He has shown that the "equivalence" which has been suggested between an electrolytic resistance and that of a system of capacity and solid resistances is false. It is now shown, from math. considerations, that the simplest combinations of capacity and resistance, whether parallel or in series, cannot satisfy the

2 laws. It is also shown that both capacity and resistance are functions of time.

H. F. JOHNSTONE

The interionic attraction theory of electrical conductance. JOHN W. WILLIAMS and HANS FALKENHAGEN. *Chem. Reviews* 6, 317-45(1929).—The authors review chiefly the well-known papers of Debye and Hückel, Onsager, and Debye and Falkenhagen on the cond. of strong electrolytes. Debye and Hückel introduced the reciprocal of the thickness of the ionic atm. which is proportional to the square root of the concn., thereby giving a theoretical explanation of the old Kohlrausch square-root law. Onsager improved upon Debye and Hückel's method of calcg. the ionic atm. by considering the Brownian motion of the ions. Debye and Falkenhagen, following Onsager's method, studied the effect of frequency upon the cond., and introduced the time of relaxation of the equil. condition of the ionic atm., thereby predicting a *dispersion* of the cond. at high frequencies.

MALCOLM DOLE

A note on the Hittorf idea of electrolytic conductivity. SATYENDRA RAY. *Z. Elektrochem.* 35, 469-70(1929).—Arguments are presented to show that the "ionic velocity" as usually detd. for the ions of an electrolyte is only the initial velocity in the neighborhood of the electrode and that this value changes with time and the position in the soln. Moreover, the av. velocity of the 2 ions in passing between the electrodes must be identical. The math. relation resulting from this condition is derived. H. F. J.

Viscosity and conductivity of mixed solutions of lead nitrate and ammonium nitrate. G. MALQUORI. *Gazz. chim. ital.* 59, 355-63(1929); cf. *C. A.* 22, 3852; 23, 3617.—To det. whether a complex is formed when $\text{Pb}(\text{NO}_3)_2$ and NH_4NO_3 solns. are mixed, the cond. and viscosity at different temps. and concns. were studied by the method of Mazzetti (cf. *C. A.* 19, 2155). The values obtained point to the existence of the complex $\text{Pb}(\text{NO}_3)_4^{--}$, the stability of which toward the dissociating influence of higher temps. increases with an increase in the concn. of the NH_4NO_3 . C. C. DAVIS

Conductance and transference number of the chloride ion in mixtures of sodium and potassium chlorides. DUNCAN A. MACINNES, IRVING A. COWPERTHWAIT and THEODORE SHEDLOVSKY. *J. Am. Chem. Soc.* 51, 2671-6(1929).—Transference nos. of the Cl ion in 0.1 N mixts. of NaCl and KCl were detd. by the moving-boundary method. The conductance of the Cl ion is the same in the mixts. as in the solns. of the pure salts (av. λ is 65.4) and there is, therefore, no evidence of complex-ion formation.

E. G. VANDEN BOSCHE

Theory of the mobilities of the hydrogen and hydroxyl ions in aqueous solution. E. HÜCKEL. *Z. Elektrochem.* 34, 546-62(1928).—It is assumed that the reaction $\text{H}_2\text{O}^+ + \text{H}_2\text{O} = \text{H}_3\text{O}^+ + \text{H}_2\text{O}^+$ proceeds, without heat exchange, with a frequency which increases as the temp. is raised. A model is adopted for the H_3O^+ ion which leads to a deduction of the proportionality between mobility and field strength (Ohm's law), and an expression is deduced for the velocity of the H_3O^+ ions in unit field. The 2 terms of the expression relate to the motion of the ions as a whole and to the transference of protons according to the above equation, resp. Expressions are also deduced for the mean life of the H_3O^+ ion, which is of the order of 3×10^{-11} sec. at the ordinary temp. The theory applies equally well to OH ions, the assumed reaction being $\text{OH}^- + \text{H}_2\text{O} = \text{H}_2\text{O} + \text{OH}^-$. Suggestions are offered for testing the theory experimentally. In certain non-aq. solns. the usual transport process may be accompanied by another, anomalous transport process.

B. C. A.

Some simple experiments on electrolysis. F. WEBER. *Z. physik. chem. Unter-richt* 41, 237-8(1928).

M. BEBER

A few remarks upon the theory of chemical reactions in concentrated electrolytic solutions. Bromine oxidation by chromate in concentrated salt solutions. M. BOBTSELSKY. *Z. anorg. allgem. Chem.* 182, 93-6(1929).—A general discussion in which the following facts are pointed out: (1) The reaction velocity of a process in a strongly suppressive milieu can be strongly accelerated by a specific catalyst. (2) The processes of charge and discharge constitute an elec. system which can be accelerated in either direction in the presence of Mn^{++} . (3) The H-ion effect is still a mixed neutral catalytic effect. The process neutral salt \longleftrightarrow effect \longleftrightarrow catalysis undergoes a gradual transition to neutral acid \longleftrightarrow effect \longleftrightarrow H-ion catalysis. (4) In analogous reactions, the sensitivity to H-ion appears to increase from Cl to I and from Br to I.

H. STOERTZ

Factors determining electrolytic dissociation. HERSCHEL HUNT and H. T. BRISCOE. *J. Chem. Education* 6, 1716-25(1929).—Electrolytic dissocn. is discussed from the point of view of donor and acceptor atoms. A donor atom can share a pair of electrons with an acceptor atom. The presence of donors and acceptors promotes assocn. of mols., high dielec. const. and ionization. However, assocn. of mols. may interfere with ionization. $(\text{EtO})_2\text{SO}$ and EtSO_3OEt have the dielec. consts. 16 and 42, resp., but should

have nearly equal ionizing powers as solvents. The halogen-substituted org. acids, ketone acids and amino acids are discussed. F. E. BROWN

The ionization constant of *p*-cyanobenzoic acid. EDGAR P. VALBY AND HOWARD J. LUCAS. *J. Am. Chem. Soc.* 51, 2718-20(1921).—The *prepn.* of *p*-cyanobenzoic acid is given. A modification of the Sandmeyer method (*Ber.* 18, 1497(1885)) was used. The following figures give the concn. in mols. per l., resistance in ohms and mol. cond., resp.: 0.007446, 352.9, 70.79; 0.006936, 367.5, 72.97; 0.006906, 369.6, 72.48; 0.004141, 494.0, 90.92; 0.002059, 755.3, 119.6; 0.0008235, 1347.0, 167.7. The ionization const. calculated from the above data has a mean value of 3.1×10^{-4} at 25°. The electron attraction of CN is greater than that of SO_2NH_2 and less than that of NO_2 . A. J. MONACK

Conductivity titration and the measurement of electrolytic resistance by a visual method. G. JANDER AND O. PFUNDT. *Z. Elektrochem.* 35, 206-8(1929).—The app. is the customary Wheatstone bridge; the telephone usually used as zero instrument is replaced by a small transformer, the secondary circuit of which is connected with a thermocross. During the titration, the addn. of the reagent causes a current to pass through the transformer; the resulting thermocurrent in the thermocross is then measured with a mirror galvanometer. The main advantage of this device is the elimination of the slide wire and of the successive adjustments after each addn. of reagent.

Dispersion of the conductivity of strong electrolytes. P. DEBYE AND H. FALKENHAGEN. *Z. Elektrochem.* 34, 562-5(1928).—A short account of the above phenomenon together with the authors' theory is given (cf. *C. A.* 22, 2705, 3573). B. C. A.

Hydrogen-ion concentration from the thermodynamic and electrochemical point of view. H. H. CHAKMAKJIAN. *J. Chem. Education* 6, 1659-67(1929).—This is an elementary presentation of the concepts: p_H , hydrogen electrode, relation of voltage to work, standard cell and quinhydrone electrode. Drawings of app. are included.

Measurement of the hydrogen-ion concentration in unbuffered solutions. I. The adsorbent properties of platinized platinum. I. M. KOLTHOFF AND TOHRU KAMEDA. *J. Am. Chem. Soc.* 51, 2888-2900(1929).—Frumkin and Donde's expts. with neutral salts in contact with Pt black were repeated with a platinized electrode, and the result was confirmed that such an electrode in an atm. of H_2 will adsorb the cation from a neutral salt soln. and an equiv. amt. of free acid is found in the soln. HCl , however, is not adsorbed by Pt black in an atm. of H_2 but a distinct adsorption takes place in O_2 . With NaOH , the adsorption is very marked in H_2 and reaches a max. when the soln. is about 0.0007 *N*. NaCl increases the adsorption but in high concn. causes the disappearance of the max. In an atm. of O_2 there is an apparent adsorption of NaOH , but this does not appear to be a case of true adsorption; there is probably a neutralization by $\text{H}_2\text{Pt}(\text{OH})_2\text{O}_2$ formed by the action of O_2 on the electrode. A similar explanation accounts for the abnormal behavior of NH_4Cl solns. in contact with platinized Pt in an atm. of O_2 . W. T. H.

Automatic determination of hydrogen-ion concentration. ARNOLD LASSEUR. *Pulp Paper Mag. Can.* 28, 61-3(1929).—See *C. A.* 23, 734. A. PAPINEAU-COUTURE

Experimental foundation of the passivity theory. W. J. MÜLLER. *Z. Elektrochem.* 35, 93-4(1929).—Current density-potential curves for certain anodes exhibiting active and passive states show that, although the O content has a pronounced influence on the magnitude of the cathodic residual current, the presence of dissolved O has no effect on the anodic part of the curve in the residual current region. Consequently, Hinnüber's theory of the passivating action of O dissolved in the electrolyte on the metal, which was advocated to explain the periodic passivity of Cr and Cr alloys, cannot be accepted. Various theories of passivity are discussed, and it is claimed that the phenomenon of anodic passivity is always due, primarily, to the formation of a non-conducting film (salt or basic salt), and secondarily, in the case of metals exhibiting true (chemical) passivity, to a change in the atoms of the metal caused by the high effective current d. resulting from the deposition. **Experimental foundations of the passivity theory.** J. HINNÜBER. *Ibid.* 95.—A reply. Further exptl. evidence is cited in support of H.'s theory of the passivating action of O. The displacement of the electron configuration, suggested by Muller, is questioned. R. H. LOMBARD

Optical studies on metal surfaces made active and passive by the electrochemical method. L. TRONSTAD. *Z. physik. Chem., Abt. A*, 142, 241-81(1929).—Measurements were made of the state of polarization of light reflected by Fe and Ni mirrors when by an elec. current the surfaces were rendered active and passive in a soln. of an electrolyte. The optical changes measured when the surfaces were made passive were similar to those brought about when the metal was placed in air. In alk. solns. the optical properties

tended toward a characteristic value while the surfaces were being made passive. During activation the changes were reversed, but the original conditions could never be reached. These results are best interpreted by assuming that passivity is due to the formation of an oxide layer. This layer results from pptn. of the hydrated oxide on the metal surface. After pptn. the hydrophilic oxide is drawn to the metal because of its neg. charge. H_2O is lost because of the removal of OH^- and migration of H^+ . Finally, the dense anhyd. layer prevents further passage of the current from the metal. In polarization by reversing the flow of the current, only a part of the oxide layer is removed.

H. F. JOHNSTONE

A study of the influence of the curvature of solids on the chemical and electrolytic phenomena in which they take part. L. R. LUCE. *Ann. phys.* 11, 167-251(1929).—Pizeau's optical method for measuring the thickness of alterations produced on the surface of solids is discussed. The reactions studied include: aq. solns. of H_2S on Cu and Ag; aq. solns. of the halogens on Cu and Ag; solns. of S on Cu; reduction of salts by P; H_2SO_4 on Zn; HNO_3 on Cu; displacement of metals from their salts; reactions between solids and gases. In all cases the reactions depend on the surface conditions of the solids—reactions start and continue most actively for a longer time in regions of great curvature. Two explanations are offered, one based on diffusion and the other on selective forces of adhesion or affinity in the interface, with the latter being the most preferable; measurements of e. m. f. failed to decide between the two. Ions liberated during electrolysis appear with preference at the angular points of the electrodes.

E. G. VANDEN BOSCHÉ

Overpotential of bismuth in acid solutions. WILLIAM V. LLOYD. *Trans. Faraday Soc.* 25, 525-9(1929)—The max. commutator overpotential of Bi is independent of the p_H of the electrolyte and is 0.1 v. greater than that of Sb in acid solns. M. D.

The reduction potential of the thiosulfate ion. J. SCHEFFER AND F. BÖHM. *Z. Elektrochem.* 35, 484-6(1929) - Attempts were made to measure the normal oxidation-reduction potential of solns. of $S_2O_3^{--}$ and $S_4O_6^{--}$ by direct and indirect methods. With a platinized Pt electrode and a satd. HgCl half cell and in an atm. of N_2 , the e. m. f. decreased with time and did not reach a const. value. An indirect method, wherein solns. of $Fe(CN)_6^{--}$ and $S_2O_3^{--}$ were used, showed that the normal potential of $S_2O_3^{--} \rightarrow S_4O_6^{--}$ in a neutral soln. is approx. 0.40 v. In this case also the measurements were variable but were best when the ratio of $Fe(CN)_6^{--}$ to $S_2O_3^{--}$ was high. The reaction between these 2 ions is reversible and takes place with a measurable velocity.

H. F. JOHNSTONE

Contribution to the anodic behavior of aluminum. A. GÜNTHERSCHULZE. *Z. physik. Chem., Abt. A*, 143, 62-8(1929) Exceptions are taken to the theory of an Al anode as a rectifier proposed by Muller and Konopicky (*C. A.* 23, 4383). G. B. T.

The validity of the glass electrode in ammonium chloride buffers. SAMUEL E. HILL. *J. Gen. Physiol.* 12, 813-9(1929). -Glass electrodes may be used without appreciable error to measure the p_H of NH_3 or NH_4Cl buffers. Above p_H 8.6 corrections must be applied if Na ions are present in the unknown soln. Corrections are given for p_H values from 8.6 to 9.4. A slight modification is made in the usual form of the electrode. C. H. RICHARDSON

Polarographic studies with the dropping mercury cathode. III. The deposition of cadmium from cyanide solutions. I. PINEŠ. *Collection Czechoslovak Chem. Communications* 1, 387-91(1929). Cd deposits at the dropping Hg cathode completely and reversibly from soln. of its double cyanide with K, whatever be the excess of KCN. The deposition potentials of Cd from its simple ions are: -0.567 v. in $0.0001 M$ $CdSO_4$ and -0.501 v. in $0.001 M$ $CdCl_2$. From the shifts of the deposition potentials with the concn. of the Cd salts and KCN, the disocn. of the complex cyanide into the simple ions is calcd. In fairly dil. soln. complex anions $Cd(CN)_3^-$ are formed, their complexity const. being 8×10^{18} . Polarograms were then obtained of a soln. of $CdCl_2$ in an excess of KCN. Tables of data and curves are given. CHARLES J. PEDERSON

The conditions of formation and properties of very thin electrolytic nickel deposits. K. M. OSTERLE. *Z. Elektrochem.* 35, 505-19(1929).—A study was made of the influence of the co-discharge of H^+ on the properties of electrolytic Ni layers. The spontaneous contraction, the magnetic properties and the electromotive soln. tension of thin Ni layers deposited from solns. of varying H^+ content were compared. From buffered solns. with a p_H below 4.5 a cryst. deposit was obtained. From solns. of p_H above 4.5 the deposit was more fine-grained and contained $Ni(OH)_2$ as an impurity. If the p_H of the soln. was above 6 only the hydroxide was obtained. If gelatin was added to the soln. the deposits were glossy and fine-grained, because of its action as a protective colloid. Addn. of NH_4Cl to the solns. had much the same effect as gelatin, while H_3BO_3 had no

effect whatever. The magnetic and other phys. properties of the deposits depended on the original condition and dispersity of the metal at the time of formation and how the occluded impurities affected the subsequent orientation. A greater dispersity produces a more basic metal. If the crystals contained impurities or were small and disordered the magnetic properties decreased. Working the metal by hammering, or heating also tended to reduce the magnetic properties. An x-ray study of the films confirmed many of the observations.

H. F. JOHNSTONE

Studies on hydrazine—the autoxidation. E. C. GILBERT. *J. Am. Chem. Soc.* **51**, 2744–51 (1929).—The autoxidation of hydrazine in alk. soln. was performed by passing O_2 through a fritted glass disk into the soln. Data are given for *calc. the velocity const. in solns. of 0.03 N, to 0.00 N NaOH* ($T = 25^\circ$) and *0.03 N NaOH* ($T = 20^\circ$). The autoxidation is a heterogeneous reaction and the rate may be expressed by the equation: $dC/dt = k \times pO_2 \times C^{1/n}$. The rate is governed by the rate of adsorption of hydrazine on the active surface. Increasing the OH-ion concn. first accelerates oxidation and then retards it. The max. rate of oxidation occurs at NaOH concn. 0.01–0.03 M. H_2O_2 is formed under all conditions when hydrazine in dil. alk. soln. is exposed to the action of O_2 . The autoxidation seems to be a microheterogeneous reaction since the optimum concn. of NaOH corresponds with that for the max. rate of decompn. of H_2O_2 by colloidal materials. The effects of temp., active surface, O_2 pressure, added impurities and peroxide concn. are discussed.

A. J. MONACK

Equilibrium between methoxide and hydroxyl ions in methanol-water mixtures. III. Calculation of the equilibrium constant from the dissociation constants of methanol and water. AUGUSTA UNMACK. *Z. physik. Chem.* **133**, 45–50 (1928); cf. *C. A.* **22**, 1715.—The equil. const. for the process $OMe' + H_2O \rightleftharpoons OH' + MeOH$ can be calcd. from the equation $K' = K_M(W)/K_M(M)$, where $K_M(W)$ is the disson. const. of water in MeOH and $K_M(M)$ that of MeOH (in MeOH?). $K_M(W)$ is given by $K_M(W) = K_W(W) \cdot V_W^H(H) \times V_W^H(OH)$, where $V_W^H(OH)$ is the partition coeff. of the OH ion, and $V_W^H(H)$ the partition coeff. of the H ion between MeOH and water. From this, the equation $K' = [K_W(W)/K_M(M)] [V_W^H(H)]^2 \cdot S(I)$ follows, $S(I)$ being the equil. const. for the solvation equil. of the H ion in mixts. of water and MeOH. All the quantities in this equation are known. By taking values for $K_M(M)$ obtained by hydrolysis and potentiometric measurements, resp., and values for $V_W^H(H)$ calcd. by different methods a no. of values for K' are found ranging from 0.98 to 2.00. All these values are higher than those previously found. The reasons for this are discussed.

B. C. A.

Uranyl formate. A. COLANI. *Bull. soc. chim.* **45**, 624–6 (1929); cf. *C. A.* **19**, 3183; and Oechsner de Coninck and Ravnaud, *C. A.* **7**, 3312; **8**, 28.—The system $UO_2 \cdot HCO_2H \cdot H_2O$ has been studied in the dark at 25° . The basic formate, $UO_2 \cdot 2H_2O \cdot UO_2 \cdot (HCO_2)_2 \cdot H_2O$, stable in H_2O , increases in solv. with increase in HCO_2H concn. up to 10–87%, at which point the monohydrate (I), $UO_2 \cdot (HCO_2)_2 \cdot H_2O$, starts to ppt.; at this crit. point, 6.05 g. of UO_2 is dissolved in 100 g. of soln. corresponding to 7.99 g. of I. Exposure of I to HCO_2H vapor at room temp. for 2 months gave an acid formate, $UO_2 \cdot (HCO_2)_2 \cdot HCO_2H \cdot H_2O$, which lost HCO_2H upon exposure to air, reforming I.

A. S. CARTER

Study of $MgSO_4 \cdot NaNO_3 \cdot H_2O$. I. A. BENRATH. *Caliche* **11**, 99–126 (1929); cf. *C. A.* **22**, 4040.—Tables and graphs of the various equilibria possible with these ions are presented for 15° , 25° , 50° and 97° , based on the literature and on expts. II. Wm. SCHRODER. *Ibid.* 154–62.—Exptl. checks of numerous literature calcs. of the various equilibria possible with these ions, for a temp. of 74.6° , which is close to numerous transformation points. There are graphs and tables of data.

J. HOWARD FLINT

The importance of inner diffusion in the establishing of chemical equilibria. G. TAMMANN. *Nachr. Ges. Wiss. Göttingen, Math.-physik. Klasse* **1927**, No. 4, 394–406.—Inner diffusion within crystals is an important factor in establishing the true equilibrium in systems involving mixed crystals. The relation of inner diffusion to the attaining of equil. is discussed for the following types of systems: Mixed crystals and vapor; the decompn. of mixed crystals of vitriols into a melted product and a lower hydrate; the diffusion of isomorphous salts; binary mixed crystals prepared from a fusion as compared with those from a soln.; and the sepn. of water-free mixed crystals from their soln. The relation of inner diffusion to the dependence of the width of the mixt. gap on the temp. is considered.

R. H. LOMBARD

Influence of neutral salts on acid-base equilibria. VII. Apparently anomalous behavior of a mixture of a weak base and its salt on dilution and on the addition of a neutral salt. Dissociation constant of pyridine, pyrimidone and *p*-phenylenediamine. I. M. KOLTHOFF AND W. BOSCH. *Rec. trav. chim.* **48**, 37–48 (1929).—The following dissociation consts. at 18° have been detd. by measuring the pH of mixts. of the bases and their

chlorides at different dilns. and extrapolating for infinite diln.: pyridine 1.4×10^{-9} , pyrimidone 6.9×10^{-10} , *p*-phenylenediamine 1.1×10^{-9} , 3.5×10^{-12} . Extrapolation for the first two bases is uncertain, as the diln. effect is less marked than required by the Debye-Hückel equation. The influence of adding the chlorides of K, Na and Li and the bromide, nitrate and iodide of K on the p_H of mixts. of the bases and their univalent salts and also of a mixt. of the uni- and bi-valent salts of *p*-phenylenediamine has been investigated. The anion effect on the value of $\log (f_1/f_0)$ (f_1 and f_0 are the activity coeffs. of the basic ion and the undissoed. base, resp.) is approx. the same for the 4 anions used except with pyrimidone the pronounced anion effect with the latter is attributed to the formation of complex or undissoed. salts. KCl exerts approx. the same influence on the above expression as it does in the case of a mixt. of a weak acid and its salt (C. A. 23, 3147). The cation effect decreases in the order $K > Na > Li$, which is the reverse of that observed in the acid systems. In order to account for this anomalous behavior it is suggested that Na and Li chlorides increase the ionic product of water. B. C. A.

The equilibrium between hydroxy acids and their anhydrides. M. GEHRKE AND H. H. WILLRATH. *Z. physik. Chem., Abt. A*, 142, 301-8 (1929).—The equil. between the lactides of hydroxy acids and the corresponding free acids in dil. solns. was detd. by titration with alkali before and after hydrolyzing by boiling the soln. with NaOH. Neutral red was used as the indicator. Glycolic acid showed no lactide in dil. solns. at any time. In 0.1 *N* lactic acid soln., the anhydride form disappeared after 20 hrs. of boiling. For both α - and β -hydroxybutyric acid a stable equil. was reached for which 4-5% of non-titratable anhydride existed. This value should be multiplied by 2 if no free carboxyl group is assumed to exist in the anhydride. H. F. JOHNSTONE

The equilibrium phosphoric acid-hydrofluoric acid-monofluorophosphoric acid and water. WILLY LANGE. *Ber.* 62B, 1084-8 (1929).—If FPO_3H_2 is treated with boiling H_2O , it completely decomposes into HF and H_3PO_4 . But if only a very limited amt. of water is present, there exists an equil. $FPO_3H_2 + H_2O \rightleftharpoons HF + H_3PO_4$. The same phenomenon is observed with FSO_3H . Both systems are extremely sensitive to addn. of H_2O . ALBERT L. HENNE

The hydrolysis of certain beryllium salts of strong acids. V. CUPR. *Collection Czechoslovak Chem. Communications* 1, 377-86 (1929).—The hydrolysis of sulfate, nitrate chloride, bromide, chlorate and perchlorate of Be in the concn. of 1.0 *N* to 0.001 *N* were measured by detg. the hydron concn. by the potentiometric method using quinhydrone and hydroquinone electrodes. The values obtained were confirmed by the colorimetric method. For all the Be salts, except the sulfate at higher concn., the ratio, $[H^+]/C$, where *C* is the molar concn. of the Be salt, decreases with diln. from 1.0 molar to 0.1 molar soln. With further diln. it slowly increases and finally becomes independent of diln. A diagram of the hydro-quinhydrone electrode used, tables of data, curves and formulas for the calcn. of the exponent of hydron concn. from the measured e. m. f. are given. CHARLES J. PEDERSEN

The derivation of chemical equilibrium constants. H. LUDLOFF. *Naturwissenschaften* 17, 367-8 (1929).—Gibson and Heiter have shown that, for diatomic mols., calcn. of chem. equilibria by modern statistics gives results identical with those from introduction of the Ehrenfest symmetry no. in Boltzmann's statistics. The problem has now been solved for reactions of multiat. mols. with 2 or 3 atoms equal. Knowledge of the symmetry character of vibrations, rotations and nucleus spin of these mols. allows a count of the phase cells which conform to the Pauli principle and the calcn. of the distribution of mols. over the phase cells present. For the partial pressure in a dissocn. equil. of a mol XA_2 : $\ln p_{XA_2} = \{ (f - D)/KT \} + \ln \pi_i (1/1 - e^{-h\nu_i/KT}) + \ln \pi_{A_2} + \ln T^4 + \ln g_A + \ln (\sigma^4 \pi^{5/2} h^4 \sqrt{m^3 P \phi R/h^6 (3.2)})$, in which *f* is free energy per mol., *D* dissocn. work, ν_i the proper vibration, *P*, *Q* and *R* are the 3 moments of inertia, σ (= 3.2) is the Ehrenfest symmetry no., g_A the wt. of the basic electron condition of the mol., z_A the no. of conditions of the nucleus spin. The last factor in the equation is identical with the chem. const. B. J. C. VAN DER HOEVEN

Kinetics of the hydrolysis of certain glucosides. III. β -Methylglucoside, cellobiose, melibiose and turanose. EMYR ALUN MORLWYN-HUGHES. *Trans. Faraday Soc.* 25, 503-20 (1929); cf. C. A. 23, 5089.—It is emphasized that the relative rates of hydrolysis of 2 glucosides may vary with temp. The rate of hydrolysis at 60° and 80° by *N* HCl of β -methylglucoside, cellobiose, melibiose and turanose, was detd. and the "crit. increments" were calcd. The stability of the disaccharides towards acid is governed by the position of the O atom link between the 2 monoses, the order of stability being position 1 > 6 > 4. A theory of unimol. reaction gives the following provisional nos. of degrees of freedom for the hydrolyses 45 (glucosides by acids), 48 (galactosides by acids), 52 (sucrose by invertase), 121 (starch by amylase). MALCOLM DOLÉ

The different reduction velocities of gold chloride by glassy and crystalline arsenic acid. E. JENCKEL. *Z. anorg. allgem. Chem.* 182, 314-8 (1929).—It is observed that a soln. of AuCl_3 is reduced 4-5 times more rapidly at 20° by As_2O_3 from an As_2O_3 glass than by octahedral crystals of As_2O_3 . The explanation lies in the greater rate of soln. of a glassy substance than a cryst. solid.

S. LENHER
Oxidation velocity of hydrogen bromide by means of chromic acid in the presence of chlorides and the catalytic influence of Mn^{II} ions. M. BOBTELSKY AND A. ROSENBERG. *Z. anorg. allgem. Chem.* 182, 74-92 (1929); cf. *C. A.* 23, 2638.—All chlorides have a suppressing effect upon the oxidation of HBr by CrO_3 in the presence of sulfates. The max. effect is obtained with a final concn. of about 1.0 *N*. The effect decreases in the following order: $\text{Me}^I\text{Cl} > \text{Me}^{II}\text{Cl}_2 > \text{Me}^{III}\text{Cl}_3$. HCl behaves as a neutral chloride. In strong solns. the alkali chlorides have only a weakly suppressive reaction, and are about equal in effect to CuCl_2 . ZnCl_2 is strongly suppressive and insensitive to changes in concn. CdCl_2 and HgCl_2 are also strongly effective in the following order: $\text{ZnCl}_2 > \text{CdCl}_2 > \text{HgCl}_2$. In about 2 *N* final concn. the other chlorides have an accelerating effect in the following order: $\text{NiCl}_2 > \text{MgCl}_2 > \text{FeCl}_3 > \text{HCl} > \text{AlCl}_3 > \text{CrCl}_3$. The SO_4 ion is in general less sensitive to concn. changes than the Cl ion. Only MgCl_2 , FeCl_3 and MnCl_2 give Cl_2 in concd solns at 20° . Increased chromate concn. has no effect on the liberation of Cl_2 . A mixt. of 2 neutral salts gives a smaller effect than the sum of the individual effects. If one of the salts is suppressive in effect, the resultant effect is equal to the average of the 2; if both are suppressive, only the action of the more active suppressive salt seems to be effective. Mn^{II} has a marked catalytic action in liberating Br , which is strengthened in the presence of Cl ions, the degree of strengthening depending upon the character of the neutral salt. The accelerating action of MnCl_2 is strengthened by the presence of neutral chlorides even if they are usually suppressive in action. The order of strengthening effect of the chlorides is the same as the order of their accelerating action in concd. solns.

H. STOERTZ
Kinetic salt effect. III. Influence of nonelectrolytes on salt effect in ionic reactions. A. N. KAPPAUSA. *J. Indian Chem. Soc.* 6, 419-30 (1929); cf. *C. A.* 23, 2870.—K. has investigated the reaction between monobromoacetate and thiosulfate ions at different ionic concns in 20, 40, 60 and 80% (by vol.) solns. of alc. in water at 25° and 35° and in 30 and 50% (by weight) solns. of cane sugar in water at 25° . For the alc. solns. the investigated range of μ varied from 0.0025 to 0.085, at both temps. the velocity consts. in all solns. increased with increase in μ , but with increasing % of alc. the velocity consts. go through a min. for certain μ and steadily increase for others, no generalities may be drawn. It is interesting to note that the temp. coeffs. remain const. over the range of μ for any given concn. of alc. but there is no evident regularity for the variation of temp. coeff. with % alc. The exptl. slopes $d \log k/d \sqrt{\mu}$ for 20 and 40% alc. are 50% greater than the slopes calcd. from the Debye-Huckel limitation equation and in 60% alc. is 15% higher and at 80% alc. is 40% lower than the calcd. value. With the cane-sugar solns. the velocity consts. were investigated over a range of μ of 0.0025 to 0.035 in both 30 and 50% solns. The consts. increase with increase in μ . The values of the slopes show greater agreement with theory, the exptl. data in 30 and 50% being 2.6 and 3.6, resp., as compared with the theoretical values of 2.568 and 4.104. The viscosity of the solns. does not seem to affect the velocity of reaction to an appreciable extent.

WILLIAM E. VAUGHAN
The reduced equations used in chemical kinetics. W. SWIETOSLAWSKI AND J. G. ZAWIDZKI. *Bull. intern. acad. polonaise* 1929A, 295-315 (in English).—See *C. A.* 23, 3394.

J. WIERTLAK
Kinetics of the oxidation of ethane. II. W. THOMPSON AND C. N. HINSHELWOOD. *Proc. Roy. Soc. (London)* A125, 277-91 (1929).—The rate of thermal combination of O_2 and C_2H_6 has been investigated in a static system between 400° and 500° and at 100 to 760 mm. pressure. The oxidation is probably a chain reaction. The rate is affected by the total pressure approx. as in a reaction of the third order, the effect depending very much more on the partial pressure of the C_2H_6 than on that of the O_2 . It is suggested that the first stage in the reaction is the formation of an unstable peroxide; if this reacts with more O_2 , the chain ends, but if it reacts with C_2H_6 , unstable hydroxylated mols. are formed which continue the chain. The reaction is retarded by an increase in the surface exposed to the gas. From a consideration of the temp. coeff. and the influence of foreign gases on the rate of reaction it is concluded that the chains are probably not of great length.

P. H. EMMETT
A monomolecular reaction in aqueous solution which can be measured thermometrically. W. A. ROTH. *Z. Elektrochem.* 35, 186-9 (1929).—Dihydroxyacetone undergoes a transformation when it is kept in storage. This transformation is very fast

when the compd. is dissolved in H_2O . In half a min., 50% (freshly distd. sample) or 30% (older sample) of the reaction is completed. By allowing the reaction to take place in the water of a calorimeter and measuring the temp. variation, it is shown that the reaction is monomol. The heat of transformation is about $+0.43$ kg.-cal/mol. The modification occurring during storage can be detected by the change of the heat of combustion. The change with time is irregular. This seems to indicate that the reaction is sensitive to catalysts (impurities from the glass?). No attempt is made to elucidate the change occurring in the mol. structure.

ALBERT L. HENNE

Thermodynamic relations between caustic and soda saponification of esters. ALOIS MUSIL. *Monatsh.* 52, 192-219(1929).—The reaction velocities for sapon. of EtOAc, AmOAc, BuOAc and PrOAc with Na_2CO_3 were detd. at 0.2° , 10° , 20° and 30° . The calcn. of the temp. coeffs. confirmed Skrabal's (*C. A.* 16, 3570) theoretical equations.

ARTHUR FLEISCHER

Kinetics of the interaction of esters of the potassium alkyl oxides in alcohol-water mixtures. I. Reaction between potassium ethyl oxide and ethyl acetate in ethyl alcohol-water mixtures. R. F. W. SELMAN AND P. BAINBRIDGE FLETCHER. *Trans. Faraday Soc.* 25, 423-35(1929).—The reaction between KOEt and EtOAc depends on the presence of H_2O . No evidence of Et_2O was found. The reaction can be expressed by the equations (a) $ROK + H_2O \rightleftharpoons ROH + KOH$ and (b) $CH_3COOR + KOH \rightleftharpoons ROH + CH_3COOK$. The authors deduce velocity reactions for the sapon. which is bimol. The experimentally detd. const. are not true velocity const. but composite values involving the equil. const. of the equil (a).

LOUIS WALDBAUER

The influence of the polarity of the solvent on the velocity of a reaction. ROBERT N. KERR. *J. Chem. Soc.* 1929, 239-42. The reaction between pyridine and allyl bromide in various isomeric disubstituted benzene derivs. was studied, to exam. the relation between the polar properties of the solvent mol. and the reaction velocity. Solns. of the reagents were prepd., and 2 cc. of each was transferred to a tube which was sealed and placed in a thermostat. The reaction was stopped by pouring the mixt. into dd. HNO_3 . The velocity coeffs. were calcd. from $k = 1/(a - b) \ln(b(a - x)/a(b - x))$, where a , b and x are, resp., the initial concns. of pyridine and allyl bromide and the concn. of the quaternary compd. formed in t min. C_6H_6 , chlorobenzene, the 3-dichlorobenzenes, anisole, the 3 tolyl methyl ethers, nitrobenzene and the 3 nitrotoluenes were used as solvents. In some cases increase in elec. moment of the solvent mol. may be related to increase in reaction velocity; in others the velocity increases without change in moment of the solvent mol.

R. L. HERSHEY

Heterogeneous catalysis. F. HABER. *Z. Elektrochem.* 35, 533-542(1929). An address.

S. LENHER

Active centers on catalysts. HUGH S. TAYLOR. *Z. Elektrochem.* 35, 542-9(1929).—T outlines the historical development of heterogeneous catalysis which led to his concept of the unequal catalytic activity of points on surfaces. With catalysts, such as oxides, halides and sulfates, possessing an ion lattice a new variable appears. The lattice is a two-fold catalyst, composed of metallic and neg. ions both of which exert specific catalytic effects. An example is the different actions of pure ZnO , and ZnO treated with $ZnSO_4$ soln., in dehydrating C_2H_5OH . Recent measurements of heats of adsorption of gases on metal and metal oxide catalysts are discussed. The difficulty in explaining the observed max. in heats of adsorption is considered. It is emphasized that the energy of activation of a surface reaction is dependent on the prepn. of the contact substance. It is possible that for a given reaction the energy of activation is smaller the more active the catalyst. Measurements of heats of adsorption together with reactions studied on poisoned and unpoisoned catalysts demonstrate the existence of centers of different activity on a catalyst.

S. LENHER

Crystal faults and active centers in heterogeneous catalysis. ADOLF SNEKAL. *Z. Elektrochem.* 35, 567-73(1929). The general existence of crystal faults in the interior of true crystals, and even single crystals, shows the presence of surface faults independently of catalytic phenomena and adsorption measurements. Optical data give the active fraction of faults not especially activated on a surface as 10^{-3} to 10^{-2} of the total surface, which agrees well with the results of expts. with catalyst poisons on surfaces.

S. L.

Molecular orientation in the adsorption layer and heterogeneous catalysis. H. R. KRYT. *Z. Elektrochem.* 35, 539-42(1929).—K reviews work which led to the following conclusions: Adsorption of a reactant is no reason for pos. catalysis, because it reduces the mobility of the substance and because an unfavorable orientation may be effected. The points are emphasized by instances of adsorption from soln. by charcoal.

S. L.

Considerations of activation processes on surfaces. M. POLANYI. *Z. Elektrochem.* 35, 561-7(1929).—The influence of surfaces, in bringing about the recombination

of atoms, especially of H, shows the strong adsorption of free atoms. According to the new quantum mechanics this adsorption is due to surface valences, and "surface compds." are formed. The concept of valence in quantum mechanics allows such compds. to be formed simply by electron-coupling, and the compds. do not have to follow the law of multiple proportions or form a sep. phase. If an adsorbed mol. does not form a surface compd., it undergoes a tension by the surface valences. The energy of activation is supplied in part or entirely by the surface valences, the need of thermal energy for reaction is reduced, and the frequency of reactive states is increased. Reacting mols. pass through a relative max. of potential energy during reaction. As an example of the adsorption potential of atoms, the rate of recombination of H atoms on a wall is considered.

S. LENHER

Activation of sulfur. ROBERT SCHWARZ AND PETER W. SCHENK. *Z. anorg. allgem. Chem.* **182**, 145-58 (1929).—Under the influence of the silent elec. discharge, S vapor increases greatly in reactivity, combining with H_2 to form H_2S and with CO to form COS. The equil. was studied in each case at about 450° , a secondary reaction occurring in the second case: $2COS \rightleftharpoons CO_2 + CS_2$. Dilatometric measurement indicated that no splitting of the S mol. occurred, and the short life of the activated form makes the existence of a triatomic mol. analogous to ozone improbable. The increased activity is apparently due solely to an excitation of the S mol. H. S.

Catalyzing capacity of carriers of platinum. I. E. ADADUROV AND K. I. BRODOVICH. *Ukrainskii Khim. Zhur.* **4**, Sci. Pt., 123-7 (1929).—The role of various carriers in catalytic processes is studied. Tables are compiled indicating the contact capacity of Mg, MgO, $MgSO_4$, and SiO_2 (prepd. in several ways) alone and with 10% $Al_2(SO_4)_3$, $Cr_2(SO_4)_3$, $B(OH)_3$ solns., and of Al, Al_2O_3 , $Al_2(SO_4)_3$, and porcelain alone and soaked with the above solns. and their mixts. The reaction catalyzed was the formation of SO_4 from mixts. contg. 5-7 1/2% SO_2 passing over the catalyst at a speed of 2 l. in 17 min through a glass tube of 20-mm diam.

JAROSLAV KUČERA

Homogeneous catalysis. II. Intermediate addition compounds and chain reactions A. W. PORTER. *Trans. Faraday Soc.* **24**, 710-2 (1928). The vapor pressure of the components of condensed systems should be studied, since their use in place of concns. leads to more nearly exact equil. expressions. The applications of the previously derived equations (cf. *Trans. Faraday Soc.* **24**, 343, 405), to the reaction $A_2 \rightarrow 2A$, show that the rate of disson. for a perfect gas would be $k_2 \mu_2^{1/2} d_2^{1/2}$ and not $k_2 \mu_2$ (as for concn. and final equil. would be $K = k_2 \mu_2^{1/2} d_2^{1/2} / k_1 \mu_1^{1/2} d_1^{1/2}$, where the exponential terms are activity coeffs. A third substance (catalyst) changes the vapor pressure of the components, indicating a change in reaction (cf. *C. A.* **15**, 196). Theoretical equations become very complicated as the no. of components increases, and it would be better to measure vapor pressures exptly. and fit them with empirical equations. Powerful effects of small amts. of catalyst are thus understandable. The equation representing vapor pressures of $CaCl_2$ soln. in H_2O over the whole range of soln., also represents absorption of H_2O in $CaCl_2$. When H_2O is present in small amts. the activity of $CaCl_2$ is many thousand-fold its usual value. A similar explanation accounts for the catalytic action of glass. T. M. LOWRY. *Ibid.* 712; cf. *C. A.* **23**, 1337. The views of Kendall (intermediate addn. compds., *C. A.* **23**, 3621) and of Boeseken (catalysis by dislocation, *C. A.* **23**, 3619) do not exclude the possibility of compd. formation, and both should be maintained. In hydrolysis of esters, for example, the acid or alkali catalyst contributes either H^+ or OH^- , and the solvent the other (OH^- or H^+), but in the combination of C_2H_4 with Cl_2 or Br_2 , the catalyst is merely a polar compd. (H_2O , etc.) with no sp. act. in the reaction, and might even be glass or SiO_2 surfaces. This is clearly catalysis by "dislocation" and not by definite addn. compds. In this case, the formation of C_2H_5Br or C_2H_5I depends on a probably unsymmetrical displacement of electrons, caused by the catalyst creating a field of force which destroys the normal symmetry of the system, thus detd. the direction of electron flow. F. GIORDANI. *Ibid.* 717-9.—Referring to Boeseken's views (cf. *C. A.* **23**, 3619), G. holds that the intermediate compd. theory is still useful and that it is necessary for compd. formation to take place with appropriate groups of mols. For ester formation, or hydrolysis, compd. formation of the *excess* type is imagined, as the addn. must weaken the principal valence bonds and increase reactivity. Thus, in studying the Perkin synthesis (cf. *C. A.* **10**, 2883) compds. formed between nitrobenzaldehydes and Ac_2O are quite different from the compds. obtained in the presence of a particular catalyst (e. g., stable and well-defined diacetates with no influence on the reactions). G. criticized Boeseken's interpretations of A in the Arrhenius equation (cf. *C. A.* **21**, 3797) and considering the reaction $M \rightarrow P$, with a catalyst N , forming the reactive compd. MN , found that: $d \log k/dT = (d \log h/dT) + d \log K/dT = (d \log h/dT) + Q/RT^2$, where Q is the heat of formation of the addn. compd. Re-

plying to Lowry (above), G. stated that the photochem. effect resulted in the resonance of valency electrons originated by impinging radiation (cf. *C. A.* 11, 1154) and the formation of an addn. compd. would cause a reduction of the restoring force and thus a modification of the characteristic frequency. Thus, the reaction of the catalyst would correspond to a shift of the characteristic frequency toward higher wave lengths. J. BÖRSEKEN. *Ibid* 719-20.—B., replying to Giordani's remarks (above), agreed with him on the formation of intermediate compds., but distinguished between *phys.* and *chem. catalysis*, and believes that elucidation of catalytic action should be sought in the phys. phenomena alone. B. also agreed with Giordani on the significance of A in the Arrhenius equation, but presumed that the change in A by a catalyst was given in a more general form by the Scheffer-Kohnstamm formulas (cf. *C. A.* 23, 3619) because the entropy-increment, as well as the energy-increment, was changed. J. Y. MACDONALD. *Ibid* 720.—In connection with the second alternative mechanism proposed by Norrish and Smith (*C. A.* 23, 3407) to account for the formation of nitrosyl cyanide, M. points out that pure NO decomposes in light of 2000 Å. U., and the obvious explanation is: $\text{NO}' + \text{NO} = \text{N}_2 + \text{O}_2$, and it is thus unnecessary to assume that NO_2 acts as carrier for the lesser amt. of energy involved in the combination with $(\text{CN})_2$. Norrish and Smith's theory that nitrosyl cyanide was formed as an intermediate product could be proved by analysis of the gas mixt. III. Neutral salt and activity effects. J. N. BRÖNSTED. *Ibid* 726-9.—B. does not agree with Giordani's (*Trans. Faraday Soc.* 24, 723) conclusion that the coeff. G ought to vary with the nature of the acid catalyst. Giordani is quite right in pointing out that a const. value of τ in the equation $K = G \times K^*$ is called for. Exptly x varies from 0.8 to 0.4, indicating that the mechanism is not fully understood. Replying to McBain (*Trans. Faraday Soc.* 24, 722-3), B. stated that in concd. solns., particularly when multivalent ions were present, undissocd. salt-mols. of polar nature do exist. Transference expts in mixed salt solns. are not suitable for study of this question (cf. *C. A.* 20, 1936), and electrometric expts. (*C. A.* 15, 3578) have shown that undissocd. mols. like MgCl_2 are not present even in strong MgSO_4 soln. Lowry's (*Trans. Faraday Soc.* 24, 725) and Dawson's (*C. A.* 23, 2347) criticisms are characterized by a lack of appreciation of the kinetic salt effect—that is, in the inversion of cane sugar the effect of added NaCl is not direct acid catalysis, but a primary salt effect interpretable as a medium effect not contradictory to the assumption of the H ion being the only catalytically active mol., and in the diln. of an AcOH-acetate buffer, the change in H-ion concn. is a secondary salt effect. Dawson's explanation of the increased dissoen. of a weak acid on the addn. of a salt by attributing a polar structure to the acid, is unacceptable because it is already satisfactorily accounted for, without any such assumption, on the basis of the ionic attraction theory. Regarding Euler's report (*C. A.* 23, 1339), B. does not believe that the explanation of the glucose mutarotation catalyzed by electrically neutral mols. (AcOH or NH_3) could be reconciled with the increased activity of the ions. Rather radical revision of the points of view of the "ionization theory" of catalysis is thus indicated, and this theory should actually be regarded as a special case of the theory of compd. formation, although B. is unable to visualize the kinetic significance of compd. formation as a general explanation of kinetic or catalytic phenomena.

A. T. FELLOWS

Acid and salt effects in catalyzed reactions. XX. The ionization of acids in salt solutions. HARRY M. DAWSON AND WILLIAM LOWSON. *J. Chem. Soc.* 1929, 1217-29; cf. *C. A.* 23, 3148.—The influence of the concn. of neutral salt solns. on the ionization const., K , of a number of acids was detd. from the velocity of hydrolysis of ethyl acetate in NaCl solns. (0.4 mol. per l.). Acetic, glycolic, chloroacetic and dichloroacetic acids were used as catalyst. The catalytic effect of HCl mols. in these solns. is inappreciable and consequently K for HCl is very large. As a result, the reaction velocity data for the various acids in solns. of NaCl may be applied to the derivation of the i -ion concns. The interpretation of the reaction velocity data does not involve any assumption which necessarily distinguishes between the activities and the concns. of the reacting substances. The addn. of NaCl raises K in all cases to a max. 70% greater than K for the salt-free soln. This max. is reached at a NaCl concn. between 0.5 and 1.0 mol. per l. At a salt concn. 4 times the concn. for which K is a max. the degree of ionization of the acid is again the same as in the salt-free soln. The influence of the salt on K is expressed by the equation $R_x = \log K_x/K_0 = \sqrt{x} - bx$, where K_x and K_0 are the ionization const. in an x -molar salt soln. and in pure water, resp. The const. a and b are approx. independent of the nature of the acid. This equation is quant. incompatible with the expression for R_x derived from the Debye-Hückel theory. Contrary to the ionic-strength hypothesis, it appears that the activity coeff. of an electrolyte varies with the nature of the electrolyte and of the

ionic environment. The relation between k_m and K derived from catalytic observations on the acetone-iodine reaction may be expressed by the equation, $k_m/k_h = 3.00K^{0.64}$.

MERRILL W. SEYMOUR

School experiments in ammonia synthesis over calcium cyanamide. HANS ZEITLER. *Z. physik. chem. Unterricht* 42, 16-22(1929).—App. is described and teaching possibilities are discussed.

M. BEBER

Catalytic action of platinum and the law of mass action. BERNHARD BATSCHA. *Z. physik. chem. Unterricht* 41, 226-8(1928); cf. *C. A.* 22, 2307.—The teaching value of the expt. on the disocn. of water is discussed, its use in illustrating the specific catalytic action of Pt and chem. equil. being stressed. An app. for the expt. is described.

M. BEBER

Catalytic decomposition of ammonia. II. G. M. SCHWAB AND H. SCHMIDT. *Z. physik. Chem., Abt. B*, 3, 337-59(1929); cf. Schwab, *C. A.* 21, 3531; 22, 1522.—The catalytic decompn. of NH_3 at the surface of Pt was investigated over a range of 0.25-4 mm. and 10-300 mm. of NH_3 between temps. of 1100° and 1485° abs. A new process of obtaining a const. temp. is described. In the first range the decompn. can be expressed by the equation $-dx/dt = k_1[\text{NH}_3]/[\text{H}_2]$. The inhibitive action of N which has been observed at lower pressures vanishes in this range. The heat of activation is 44,000 g.-cal. per mol. In the second range the decompn. cannot be represented by so simple an equation as the first. In this case the velocity may be represented approx. by $-dx/dt = k_2[\text{NH}_3]^{1.4}/[\text{H}_2]^{2.8}$. The heat of activation in this range is 140,000 g.-cal. per mol. In the lower pressure range the adsorbed NH_3 decomposes in part on the active surface. A comparison with previous work on other metals with regard to the heat of activation shows that the decompn. is normal and comparable with other metals only in the lower pressure range. In the higher range the heat of activation is much greater than would be expected. This is not due as has formerly been supposed, to the heat of desorption of H, but to the abnormal mechanism of the reaction.

B. C. A.

New measurement on the catalytic decomposition of ammonia. GEORG M. SCHWAB AND HILDEGARD SCHMIDT (FRL.). *Z. Elektrochem.* 35, 605-7; cf. preceding abstract.—The thermal decompn. of NH_3 by a Pt wire at pressures from 0.25 mm. to 4.0 mm. at temps. from 1000° to 1200° is measured. The reaction follows the equation $-d(\text{NH}_3)/dt = k_3(\text{NH}_3)/(\text{H}_2)$. The mechanism of the process is discussed.

S. LENDIER

Combination of hydrogen and oxygen on the surface of platinum. REGINALD P. DONNELLY AND CYRIL N. HINSHELWOOD. *J. Chem. Soc.* 1929, 1727-33.—The reaction was studied on a wire heated below the temps. at which explosion takes place. The reaction at ordinary pressures follows a different law from that found by Langmuir at low pressures. The existence of active centers of different kinds on Pt wire is affirmed. The reaction is independent of the pressure of H_2 and dependent on the pressure of O_2 , indicating no appreciable displacement of O by H_2 on the wire. The max. rate of combination found possible without explosion was 4% per min. with 200-mm. H_2 and 100-mm. O_2 . There were no definite indications of chain reactions extending out from the wire. N_2 or A lowered the explosion temp. from 200° to 180° and caused an acceleration of the isothermal reaction of 20-30%. NO_2 had no effect but to poison the heterogeneous reaction.

GREGG M. EVANS

The method of catalytic hydrogenation. VERA VRABÉLY. *Maayar Chem. Folyóirat* 35, 28-32, 38-43(1929).—A summary of the literature and a crit. description of methods of catalytic hydrogenation, i. e., reduction with Pt black and H_2 . S. S. DE F.

Carbon dioxide-carbon monoxide equilibrium over copper. F. HALLA. *Z. anorg. allgem. Chem.* 180, 83-8(1929).—Remarks on the paper by Brody and Möller (cf. *C. A.* 21, 3326). The O_2 partial pressure of Cu_2O (in the equil. $\text{Cu}_2\text{O} \rightleftharpoons 2\text{Cu} + \frac{1}{2}\text{O}_2$) was calcd. It is lower than that of CuO (in the equil. $2\text{CuO} \rightleftharpoons 2\text{Cu}_2\text{O} + \frac{1}{2}\text{O}_2$) at the same temp. Values found for the CO/CO_2 ratio in the COCO_2 equil. over Cu were decidedly higher than those of B. and M. Nevertheless, their conclusions are satisfactory: Below 600° , no appreciable reduction of CO_2 by Cu can be detected. ALBERT L. HENNE

Reaction velocity between caustic soda solution and carbon dioxide. SHINROKU MITSUKURI. *Science Repts. Tôhoku Imp. Univ.* 18, 245-97(1929).—The velocity of the reaction between CO_2 and NaOH soln. was detd. by 4 different methods, (1) by measuring the velocity of bubbles of CO_2 ascending through caustic solns.; (2) by observing the rate of decrease of the size of a bubble of CO_2 suspended in a moving stream of NaOH ; (3) by detg. the amt. of CO_2 picked up by drops of NaOH falling through a CO_2 atm.; and (4) by measuring the decrease in pressure of CO_2 gas in contact with

a large vol. of NaOH. The results are explained by the assumption that the reaction velocity is detd. by the rate of combination of CO_2 and NaOH at the gas-liquid interface, and by the rate of diffusion of NaOH from the interior of the liquid to the interface. An unexplained increase in the reaction velocity of CO_2 with decreasing pressure was noted by method (4) with 4, 6 or 8 N NaOH, but not with 1, 2 or 3 N . P. H. E.

The rapid absorption of hydrogen by permanganate solutions containing silver salts. FR. HEIN AND W. DANIEL. *Z. anorg. allgem. Chem.* 181, 78-82(1929).—The rate of absorption of H_2 by a series of KMnO_4 solns. was studied. The optimum concn. for the KMnO_4 solns. was about 0.008 N , while higher concns. showed less absorption. The addn. of AgF to the KMnO_4 increased the velocity of absorption with a max. at 0.02 M AgF concn. AgNO_3 exerted a greater effect on the reaction velocity, the max. rate being 24 l. cc./min. for a 0.06 M AgNO_3 concn. in a satd. KMnO_4 soln. The above observations were confirmed by absorbing the H_2 from mixts. of H_2 and N_2 by the AgNO_3 - KMnO_4 solns. The solns. were in each case freshly prepd. and not allowed to come into contact with any Pt metal. The reactions involved in the absorption of the H_2 are now the subject of study. It can be said already that it is not AgMnO_4 alone which causes the increased absorption rate, because AgMnO_4 alone shows an absorption rate of only 13 cc./min. The presence of excess AgNO_3 seems to be necessary. $\text{Cu}(\text{NO}_3)_2$, $\text{Hg}(\text{NO}_3)_2$ and $\text{Pb}(\text{NO}_3)_2$ caused only a slight increase in the rate of absorption.

L. L. QUILL

New kinds of mixed crystals. VII. The system: ferric chloride ammonium chloride. D. BALAREFF. *Z. anorg. allgem. Chem.* 168, 292-6(1928); cf. *C. A.* 21, 517, 3502; 22, 2089.—B. compares his studies on the systems BaSO_4 and other sulfates with Roozeboom's observations on the system: $\text{FeCl}_3\text{-NH}_4\text{Cl}$ (*Z. physik. Chem.* 10, 145(1892)), with respect to: (1), the variation in compn. of crystals from the same solns.; (2), the presence of free water in the crystals; (3), the absence of salts of other acids in the crystals; (4), the appearance of double refraction in the crystals, this property disappearing in time. Both the $\text{FeCl}_3\text{-NH}_4\text{Cl}$ system and the $\text{BaSO}_4\text{-R}_2\text{SO}_4$ systems behave analogously with respect to these phenomena. VIII. *Ibid.* 169, 257-63.—There are apparently no conditions under which pure BaSO_4 , *i. e.*, free from K_2SO_4 and H_2O , can be pptd. from a soln. contg. KCl . The type of structure of the adsorbed foreign salt in pptd. BaSO_4 does not det. the amt. adsorbed. $\text{BaSO}_4\text{-K}_2\text{SO}_4\text{-H}_2\text{O}$ is anisotropic when pptd., but heating makes the crystals isotropic. The capillaries must be increased in regularity and av. length; this is shown by exptly. more rapid coloring of the isotropic form by KMnO_4 soln. BaSO_4 crystals are specifically adsorptive, only polar solid salts being adsorbed. The growth of the crystals is supposed to take place with an increasingly thick layer of soln. of the foreign salt surrounding the crystal; this finally halts the regular development, and the crystal grows in other directions, the whole process being such that only small parts of the adsorbed layer and mother liquor are mechanically enclosed. IX. D. BALAREFF, R. KAISCHIEW AND B. SREBROW. *Ibid.* 174, 295-317.—Under given conditions only certain adsorption compds. are formed, although ions may be present which would form other such compds.; thus new expts. show that on pptd. BaSO_4 , either K_2SO_4 or a Ba salt may be adsorbed but not both. These compds. may be considered as between the ions of BaSO_4 in the crystal lattice and the adsorbed sulfate, but these adsorption compds. do not show the properties of the adsorbed sulfate in the solid state, since the adsorbed sulfate is not oriented on the adsorbent surface. H_2O is always necessary for the production of these adsorption compds., more adsorbed salt corresponding to more enclosed H_2O , and different amts. of H_2O corresponding to the same amt. of different adsorbed salts. Adsorption compds. are capable of change into others, $\text{BaSO}_4\text{-H}_2\text{O-BaCl}_2\text{-HCl}$ changed to $\text{BaSO}_4\text{-H}_2\text{O-K}_2\text{SO}_4$ under the addition of K_2SO_4 . Polar and apolar compds. may be distinguished, the polar following Paneth's rule and the apolar not; examples are, resp., BaSO_4 -sulfate systems and $\text{NH}_4\text{Cl-H}_2\text{O-FeCl}_3$. Polar compds. do not follow the distribution law, the curve of the amt. adsorbed vs. concn. being an adsorption curve, increasing rapidly from zero with slight increase in concn. The similarity of the structure type of the adsorbed and adsorbing compds. exerts no influence on formation of polar compds. The adsorption compd. influences the method and rate of growth of the elementary pptd. particle. These facts support the views that the forces detg. adsorption are in the nature of residual valences. A review of the BaSO_4 - KMnO_4 studies shows that no pure system exists, but that the amt. of KMnO_4 depends on the presence and amt. of another adsorption compd. The KMnO_4 apparently penetrates into the pores of the pptd. adsorption compd. BaSO_4 contg. K_2SO_4 may thus be a semipermeable membrane, passing KMnO_4 but not KCl since this latter salt cannot dissolve in $\text{BaSO}_4\text{-H}_2\text{O-K}_2\text{SO}_4$.

R. L. HERSHEY

The enne- and di-hydrates of ferrous bromide. F. SCHIMMEL. *Ber.* 62B, 963-6 (1929).—The soly diagram of FeBr_2 in H_2O was detd. completely. The results are tabulated and plotted. The hydrates found contained 9, 6, 4 and 2 mols. of H_2O , resp., per mol. FeBr_2 . ALBERT L. HENNE

The reduction equilibrium of lead sulfide and the chemical constants of sulfur and hydrogen sulfide. KARL JELLINEK AND AUGUST DRUBEL. *Z. Elektrochem.* 35, 451-7 (1929); cf. C. A. 19, 1513.—In order to det. the chem. const. of S_2 and H_2S it is necessary to ascertain the reduction equil. $\text{PbS} + \text{H}_2 \rightleftharpoons \text{Pb} + \text{H}_2\text{S}$ at temps. between 900° and 1300° . The S tension over PbS-Pb also was calcd. The heat of formation, Q_0 , of cryst. PbS from Pb and S_2 is 40 800 cal. The heat of transformation of pptd. PbS into the cryst. form is 5500 cal. The chem. const. for S_2 and for H_2S are 2.43 ± 0.3 and -0.79 ± 0.2 , resp. L. F. AUDRIETH

Dehydration of Glauber salt by aqueous ammonia. G. YAKOVKIN. *Trans. State Inst. Applied Chem.* (Moscow) 1927, No. 8, 5-13.—In a search for the most economic method of dehydrating $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$, the action of NH_3 as dehydrating agent was studied by detg. the solvilities of the sulfate at various temps. in NH_3 solns. contg. 5-35 g. NH_3 per 100 cc. H_2O . Eight soly. tables are given from which the following conclusions are drawn. When the concn. of NH_3 is about 15 g. per 100 g. H_2O , temp. variations have no effect on the soly. of the sulfate, and the heat of soln. of the sulfate is nil. At lower concn. of NH_3 the soly. of the sulfate decreases slightly with increase in temp., and the heat of soln. of the anhyd. salt is pos. In NH_3 solns. contg. 15-35 g. NH_3 in 100 g. H_2O the soly. of the anhyd. sulfate increases with the temp., indicating a neg. heat of soln. Thus solns. of 5 g. NH_3 in 100 g. H_2O dissolve 34.75 g. anhyd. sulfate at 30° and 32.5 g. at 50° , whereas solns. of 30 g. NH_3 in 100 g. H_2O dissolve 3 g. anhyd. sulfate at 30° and 3.55 g. at 50° . In general, the influence of temp. on the soly. of Na_2SO_4 in aq. NH_3 solns. is relatively small, the influence of NH_3 concn. is considerably greater. As a dehydrating agent, NH_3 has the advantage of lowering the Na_2SO_4 soly. to an extent considerably greater than MeOH or EtOH . The expense of heat in the course of dehydration of $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ is about the same with any of the 3 dehydrating agents. BERNARD NELSON

A deformation study of cobalt oxide-silica mixtures. T. M. FELTON. *J. Am. Ceram. Soc.* 12, 548-51 (1929).—The deformation eutectic temp. is 1325° , and the compn. 32% SiO_2 and 68% Co_3O_4 . The compn. of the Al_2O_3 - Co_3O_4 eutectic is about 10% Al_2O_3 and 90% Co_3O_4 . The eutectic temp. of the Co_3O_4 - Al_2O_3 - SiO_2 system is 1200° and the compn. 38% SiO_2 , 20% Al_2O_3 and 42% Co_3O_4 . Adding up to about 70% SiO_2 will greatly reduce the melting temp. of Al_2O_3 and Co_3O_4 . Co_3O_4 in the presence of Al_2O_3 and SiO_2 is a very active flux. This may account for the tendency of Co colors to spread. C. H. KERR

Chemical equilibria between solid salts. C. TUBANDT AND H. REINHOLD. *Z. physik. Chem., Abt. A*, 140, 291-308 (1929). The equil. between pairs of solid salts (sulfides, selenides, tellurides and halides of Ag and univalent Cu) is established according to the law of mass action, e. g., in the systems $\text{Ag}_2\text{S} + 2\text{CuI} \rightleftharpoons \text{Cu}_2\text{S} + 2\text{AgI}$ and $\text{Ag}_2\text{S} + \text{Cu}_2\text{Se} \rightleftharpoons \text{Cu}_2\text{S} + \text{Ag}_2\text{Se}$. The equil. const. were detd. at various temps. and the heats of reaction calcd. EMIL KLARMANN

Contribution to ion exchange, especially in permutites. G. WIEGNER AND K. W. MÜLLER. *Z. Pflanzenernähr., Düngung u. Bodenk.* 14A, 321-47 (1929). Studies of the ion exchange between the cation of a neutral salt soln. and the cations of a permutite were made in different alc.-water solns. and in different concns. of dextrose and of cane sugar. In the alc.-water mixts., the ion series changed with increasing concns. of alc. and took place in the order of the true ion vols., apparently because of a decrease in the hydration of the ions. However, dextrose and cane sugar did not significantly affect the exchanges as obtained in a water soln. of the electrolytes. The dielec. const. of some of the electrolyte-free dextrose solns. were as low as those of the alc.-water mixts., where an altered exchange was observed. The dielec. behavior of the dispersing solns. could not explain the altered exchange of the alc.-water mixts. Evidently the large mol. diams. of the dextrose and cane sugar did not permit an entrance of these solns. in the very small capillaries—the inner dispersion—of the permutite. No specific adsorption of the sugar solns. took place. Methylene blue showed very small exchange capacity with permutites and did not enter the large pieces of permutite. R. M. BARNETTE

A dilatometric study of some univariant two-phase reactions. PIERRE A. CHEVENARD, ALBERT M. PORTEVIN AND XAVIER F. WACHE. *J. Inst. Metals*, Advance copy No. 502, 29 pp. (1929).—The advantages of the dilatometric method of studying thermal transformations in alloys are discussed, and there is shown, in a study of the Fe-Ni-Cu

alloys, the phys.-thermal reaction which takes place in the two-phase alloys and which is superimposed on the ordinary transformation occurring in ferro-nickels. D. S.

The decomposition of thallic oxide. A. B. F. DUNCAN. *J. Am. Chem. Soc.* **51**, 2697-705(1929).—App. and exptl. details are described. The decompn pressure of pure Tl_2O_3 , K_p , the heat of reaction, ΔH , and the free energy, ΔF , at the temps. and pressures of expt. are:

Temp., °K.	949	973	997	1025	1043
Pressure, cm. of Hg	4.2	11.5	25.5	50.0	80.0
K_p , atm. of O_2	0.0552	0.1515	0.338	0.656	1.052
ΔH	77,000	71,400	77,000	77,000	
ΔF	5,479	3,672	2,163	352	—106

A new detn. of the $m \cdot p$ of thallic oxide gave $717 \pm 5^\circ$. The equil pressure of O_2 depends on the temp and the compn of the mixt of oxides. Tl_2O dissolves in Tl_2O_3 , forming solid and liquid solns. The solns. of the oxides appear to obey Raoult's law over the concn range investigated. A. J. MONACK

The thermal decomposition of gaseous ethylene oxide. WINFIELD W. HECKERT AND EDWARD MACK, JR. *J. Am. Chem. Soc.* **51**, 2706-17(1929).—The thermal decompn of ethylene oxide in a Pyrex chamber at $380-444^\circ$ is a strictly homogeneous gas reaction. The velocity of decompn, k_1 , is $\ln k_1 = 34.02 - (52,000/RT)$. The reaction occurs in 2 steps with perhaps acetaldehyde as an intermediate compd. A mechanism proposed for the reaction involves a unimol isomerization to acetaldehyde mols. of high energy content and their subsequent unimol decompn. into CO and CH_4 . The variation of k_1 with both pressure and temp was studied, as well as the variation of k_2 with pressure at 394.3° . There is an induction period and a decrease in k_1 in the presence of inert gases proportional to the ratio of pressure of the inert gas to that of the ethylene oxide. In hydrocarbons the depression of k_1 is related to the complexity of the mol. Argon and neon depress the rate less than any of the other gases (CO_2 , CO , N_2 , CH_4 , C_2H_6 , propane, isobutane, He). Helium depresses the rate considerably; H_2 increases the velocity of decompn. A. J. MONACK

The thermal decomposition of acetone in the gaseous state. F. O. RICE AND R. E. VOLLRAITH. *Proc. Nat. Acad. Sci.* **15**, 702-5(1929).—The purpose of this investigation was to study homogeneous unimol gas reactions. In previous work (see Hinshelwood and Hutchison, *C. A.* **20**, 2933) the reaction was followed by noting pressure increase. R. and V. used a flow system, satg. N_2 with acetone, passing through an electrically heated quartz tube, and collecting the products in wash bottles. The reaction was followed by analysis of the reaction products. They found approx. 60 mols. of ketone for every 100 mols. of acetone decompd. They suppose the primary process is the homogeneous unimol decompn. $CH_3COCH_3 \rightarrow CH_3CO + CH_4$, and that this is followed by the bimol. change $2CH_3CO \rightarrow C_2H_4 + 2CO$. Accordingly, 100 mols. of acetone should give 100 mols. of CH_4 , 30 mols. of C_2H_4 and 60 mols. of CO, which corresponds closely to the results of gas analysis by Hinshelwood and Hutchison. Methods in which the rate of change of pressure is used for following the course of reaction are unreliable. G. R. YOHE

The dissociation of nitric oxide. P. RISCHBIETH. *Z. physik. chem. Unterricht* **41**, 184(1928).—The disson. of NO, prepd. from $NaNO_2$, H_2SO_4 and Hg is carried out, by means of a glowing Pt wire in a gas buret, over water. Four vols. NO yield 1 vol. N_2 , according to $4NO = N_2 + 2NO_2$; $2NO_2 + H_2O = HNO_3 + HNO_2$. In order to prevent melting, the Pt wire should be 0.5 mm. thick. M. BERBER

Thermal analysis. Systems containing lead chloride and mercuric chloride as solvents. H. PÉLABON AND MILLÉ LAUDR. *Bull. soc. chim.* **45**, 488-92(1929).—System: $PbCl_2-PbF_2$.—A eutectic was obtained at 461.5° with a compn. corresponding to 43 mol. of PbF_2 and 457 mol. of $PbCl_2$. System: $PbCl_2-PbO$.—Compn. of eutectic 30 mol. PbO , 70 mol. $PbCl_2$. The eutectic temp. was 402° . No oxychloride of Pb was observed. System: $PbCl_2-PbI_2$.—Eutectic melts at 338° . The curve indicates disson. of PbI_2 . System: $PbCl_2-AgCl$.—Eutectic compn 61 mol. $AgCl$, 39 mol. $PbCl_2$. Eutectic temp. 201° . System: $PbCl_2-CuCl$.—Eutectic temp. 258° . The cryoscopic const for $PbCl_2$ was calcd. to be 642.64. System: HgI_2-CdI .—This system shows a simple series of mixed crystals. System: HgI_2-HgI .—Eutectic compn. 47.5 mol. HgI , 52.5 mol. HgI_2 . Eutectic temp. 227° . Because the equil. $2HgI \rightleftharpoons HgI + Hg$ establishes itself too rapidly the fusion curve for mixts. rich in HgI could not be obtained nor could the fusion temp. of HgI be obtained. The mixts. of HgI_2 and HgI were analyzed by detg. the Hg and I. This was accomplished by taking a sample of the mixt.,

dissociating it by heat, fixing the I with a weighted Cu spiral and catching the condensed Hg. A simple calcn. then gave the compn. of the mixt. F. W. LAIRD

Thermal decomposition of water vapor into hydrogen and free hydroxyl. K. F. BONHOEFFER AND H. REICHARDT. *Z. physik. Chem.* 139, 75-97(1928).—Spectroscopic evidence for the thermal disson. of water vapor into H and free OH was obtained at temps. above 1300°. The disson. const. of the reaction was calcd. from a complicated series of considerations. The disson. const. is given by: $\log K_{OH} = -(U_0/4.571 T) + (\Sigma C_{p0} \log T/1.986) + (1/4 571) \int_0^T (1/T^2) dT \int_0^T \Sigma C_{pT} dT + \Sigma i$, where the symbols have their usual connotation. The chem. const. were calcd. from the Sackur-Tetrode equation, the moments of inertia being derived from spectroscopic data: $\Sigma i = 2i_{OH} - i_{H_2} - i_{O_2} = -0.82 + 3.36 - 0.53 = +2.01$. Classical values for diatomic mols were assumed for C_{p0} terms; and the C_{pT} terms were calcd. from $\phi(\nu/T) = R(h\nu/kT)^2 e^{h\nu/kT} / (\nu e^{h\nu/kT} - 1)^2$, in which to ν the following values were assigned for H₂, O₂ and OH, resp.: 5000, 3600 and 5100. The OH value was obtained by adopting that corresponding with the vibrational energy in the OH band spectrum, $\nu = 3570 \text{ cm}^{-1}$. The values of K_{OH} so calcd. differ but slightly from the accepted values of K for the reaction $2H_2 + O_2 = 2H_2O$. The most intense absorption in the expts. recorded corresponds with a partial pressure of OH of 8 mm. at 1600°. B. C. A.

The optical determination of heats of dissociation. Remark on the paper of G. H. Visser of the same title. A. TERENIN. *Physica* 9, 283-5(1929). (In German).—Visser's results (*C. A.* 23, 3164) are partly explained by the use of heats of formation of solid salts not of gaseous disson. Other points are discussed. Reply. G. H. VISSER. *Ibid* 285-6 (in German). B. J. C. VAN DER HOEVEN

The measurement of the final heat of solution of salt hydrates. (Method of heats of dilution.) J. PERREU. *Compt. rend.* 189, 285-7(1929).—Two methods were used to det. the value of L (final heat of soln.) for Matignon's formula for satd. soln. $L = X_N - (\Delta + A)$ (*Bull. soc. phil.* [9], 11, 176-84(1908)) for Na₂CO₃·10H₂O (I), Na₂SO₄·10H₂O (II), BaCl₂·2H₂O (III), Na₂HPO₄·12H₂O (IV), CuSO₄·5H₂O (V) (X_N is the mol. heat of soln. in large excess of water; Δ = mol. heat of diln.; A = heat of addn., i. e., heat evolved when a large excess of satd. soln. is added to a quantity of water which at satn. contains one g.-mol of salt). The 1st method consists in dilg. a soln. of known concn. in a calorimeter with a large excess of water and measuring the heat evolved in cal./g. at 11-12°. In the 2nd method A is measured directly by measuring the heat evolved when a small quantity of water is added to an excess of satd. soln. The values for L expressed in cal. for methods 1 and 2 are, resp., (I) -13.525, -13.52; (II) -16.805, -16.785; (III) -4.68, -4.68; (IV) -21.79, -21.79; (V) thermal effect small. These values agree with those obtained by a direct method (*Cf. C. A.* 23, 4876). E. R. S.

Dependence of heat of vaporization upon temperature. VALENTIN KIREEV. *Z. anorg. allgem. Chem.* 182, 177-81(1929).—The relation of the function L/RT to τ is studied, in which L is the mol. heat of vaporization, and τ is the ratio T/T_k . For the temp. range $\tau_k < \tau < 0.90$, an approx. general formula for different materials was obtained as follows: $K = [K_s/(1.10 - \tau_k)] (1.10 - \tau)$, in which $K = L/RT$ and K_s and τ_k are the values for these functions at the b. p. H. STOKERTZ

The thermal behavior of the phenols. II. The thermodynamics and the mechanism of the thermal decomposition of the phenols and their homologs. A. HAGEMANN. *Z. angew. Chem.* 42, 503-8(1929); cf. *C. A.* 23, 3449.—The reaction equil. resulting from the thermal decompn. and from the reduction with H and with C of phenol and *m*-cresol is treated thermodynamically. The reaction mechanism of thermal decompn., by means of hot catalysts, is discussed. F. D. ROSSINI

A new chemical theory and its thermodynamic consequences. ALBERT GOSSELIN AND MARCEL GOSSELIN. *J. chim. phys.* 26, 349-67(1929); cf. *C. A.* 23, 4605. A. F.

Some remarks concerning the paper of P. E. Verkade and I. Coops "An investigation as to the accuracy of Stohmann's thermochemical data." W. SWIETOSLAWSKI. *Rec. trav. chim.* 47, 896-900(1928); cf. *C. A.* 22, 2871.—Polemical. R. L. HERSHEY

The elimination of systematic errors occurring in the earlier thermochemical data. W. SWIETOSLAWSKI. *Rec. trav. chim.* 48, 1-6(1929); cf. *C. A.* 22, 1088, 1267 and preceding abstract.—S. maintains against objections by Verkade and Coops, that the elimination of systematic errors from earlier thermochemical data is desirable; that all corrections applied by him except one have been made with agreement of the original investigator; that his method of correction is approved; and that certain coeffs. offered by him are provisional and not final. R. L. HERSHEY

The development of heat theory by means of high pressures. A. M. J. F. MICHELS. *Physica* 9, 223-34(1929).—A lecture. B. J. C. VAN DER HOEVEN

Some radiation heat transfer formulas. O. A. SAUNDERS. *Proc. Phys. Soc. London* **41**, 569-75(1929).—The general expression for the radiation heat transfer from a surface is first considered, after which some simple cases are examd., *i. e.*, parallel planes, concentric spheres, etc. Some general conclusions are drawn for the case of a surface completely surrounded by other surfaces at a uniform temp., but of no particular simple shape. Whatever the shapes, sizes and relative positions of the various surfaces, the heat transfer per unit area must always lie between min. and max. values depending only upon temps. and emissivities. An approx. formula is given for the heat transfer when the surroundings are poor reflectors; this is applied to two non-concentric spheres, one within the other. M. C. ROGERS

Heat transfer: a liquid flowing through a porous prism. T. E. W. SCHUMANN. *J. Franklin Inst.* **208**, 405-16(1929).—S. develops a mathematical expression for the distribution of temp. throughout a prism of porous material. This formula can be applied to such cases as the heating or cooling of a mass of crushed material by passing a fluid through it. If a liquid, initially at uniform temp., passes lengthwise through a right, porous prism, initially at some other uniform temp., the sides of the prism being adiabatic and impervious to the liquid, then the temps. of both liquid and solid will be functions of time and of a distance. The problem of finding the temp. distribution is solved by assuming the well-known laws governing the transfer of heat from a liquid in turbulent motion to a solid. The soln. as presented involves the use of some mathematical functions related to the well-known Bessel functions. M. C. ROGERS

Specific heat and its zero point. I. MAJDEL. *Arch. hem. farm.* **3**, 93-103(1929) (German)(1929).—By decreasing the temp. of a body, that is by lowering the frequency of thermal vibration, it is possible to approach the limit of thermal vibration. The name of *sp. heat zero point* is proposed for the temp. in question, T_0 . At T_0 the true sp., atomic and mol. heats (c , μ and M) are 0. The study of the functional relationship between the true at. heat and temp. lead to the conclusion that for all elements in the solid state $\mu = \gamma - [\alpha/(t + \beta)]$ where $\alpha = \text{const.} = 939.8$ and γ and β are the characteristic parameters for each element. (Cf. *C. A.* **23**, 2613.) It can be seen that $\mu = 0$, when $\gamma = (\alpha/T_0) + \beta$ or $T_0 = (\alpha/\gamma) - \beta$. It is clear that this temp. T_0 is the sp. heat zero point. In a table β , γ and T_0 are given for the most common elements. The older concept of abs. zero, namely -273° , does not harmonize with this view and should be abandoned. JAROSLAV KUČERA

Entropy and specific heat of solid inorganic compounds. W. HERZ. *Z. anorg. allgem. Chem.* **182**, 189-91(1929).—The product of the entropy and the cube root of the sp. heat is given for several of inorg. compds. F. R. BICHOWSKY

The free energy of water, carbon monoxide and carbon dioxide. E. D. EASTMAN. *Bur. Mines, Circ.* **6125**, 15 pp(1929).—A crit. review of the data leads to the following equations (β -graphite is taken as the standard form of carbon): $\text{H}_2\text{O(g)}, \Delta F_T^\circ = -57,227 + 2.01 T \ln T + 2.165 \times 10^{-4} T^2 - 1.76 \times 10^{-7} T^3 - 2.24 T$; $\Delta F_{298}^\circ = -54,467$; $\text{CO(g)}, \Delta F_T^\circ = -27,217 - 4.97 T \ln T + 7.624 \times 10^{-3} T^2 - 2.049 \times 10^{-6} T^3 + 2.79 \times 10^{-10} T^4 + 9.28 T$; $\Delta F_{298}^\circ = -32,265$; $\text{CO}_2(\text{g}), \Delta F_T^\circ = -94,244 + 0.10 T \ln T - 7.1 \times 10^{-4} T^2 + 1.33 \times 10^{-7} T^3 - 4.68 \times 10^{-11} T^4 + 1.44 T$; $\Delta F_{298}^\circ = -93,647$. F. R. BICHOWSKY

The heat capacity of toluene from 14°K. to 298°K. ; the entropy and the free energy of formation. KENNETH K. KELLEY. *J. Am. Chem. Soc.* **51**, 2738-41(1929).—The methods and app. were described previously (*C. A.* **23**, 1344). No abnormal behavior was noted in either the crystals or the liquid. The *sp. heat* (C_p) between 16.72° and 166.60°K. (crystals) and 183.83° to 284.44°K. (liquid) is tabulated. The *heat of fusion* is 1582 cal. per mol. The *entropy* at 298.1°K. is 52.4 ± 0.3 E. U. The *fusion temp.* is 177.95°K. For benzene, toluene and *m*-xylene the heats of combustion are resp., 781,700, 935,100 and 1,090,500 cal. per mol.; $\Delta H_{298.1}$ (heat content) 11,120, 1930 and 5260; $\Delta S_{298.1}$ (entropy) -54.2 , -75.1 and -98.1 ; $\Delta F_{298.1}$ (free energy) 27,300, 24,300 and 24,000. A. J. MONACK

Partial molal heat capacities and relative partial molal heat functions in solutions of molten metals. ALBERT N. GUTHRIE and EARL E. LIRMAN. *J. Am. Chem. Soc.* **51**, 1711-15(1929).—The partial molal heat capacity of liquid Pb and Sb and of Bi and Cd in their mixts. is const. at all concns. The partial molal heat content of the components of these systems is zero at all temps. F. R. BICHOWSKY

The thermochemistry of hypochlorous acid and some of its salts in aqueous solution. BERNHARD NEUMANN and GEORGE MÜLLER. *Z. anorg. allgem. Chem.* **182**, 235-54(1929).—Prepn. of Cl_2 -free solns. of HOCl up to 30% is described. Stability of HOCl solns. at room temp. in light and dark was examd. The heat of diln. of 1 mol. HOCl with 6.6 to 143.3 mols. H_2O was detd. calorimetrically. HOCl is considered as a soln.

of Cl_2O in water. The heat of neutralization of HOCl with Li , Na , K , Sr , Ba and Ca hydroxides is 8940 cal. within $\pm 0.16\%$. This shows that HOCl is only slightly dissoed. The heat of soln. of 1 mol. Cl_2O in 2072 mols. H_2O is 8737 ± 7 cal. Six calcs. of heat of formation of HOCl aq. from Cl_2 + hydroxides of Na , K , Li , Ca , Sr and Ba give 30,439 cal. ($\pm 0.1\%$). From this value the heat of formation from the elements of hypochloral. ($\pm 0.1\%$). $\text{Na} + \text{O} + \text{Cl} + \text{aq.} = \text{NaOCl aq.} + 82,803$ cal. $\text{K} + \text{O} + \text{Cl aq.} = \text{KOCl aq.} + 85,748$ cal. $\text{Li} + \text{O} + \text{Cl} + \text{aq.} = \text{LiOCl aq.} + 92,190$ cal. $\text{Ca} + \text{O}_2 + \text{Cl}_2 + \text{aq.} = \text{Ca(OCl)}_2 + 180,642$ cal. $\text{Sr} + \text{O}_2 + \text{Cl}_2 + \text{aq.} = \text{Sr(OCl)}_2 \text{ aq.} + 181,446$ cal. $\text{Ba} + \text{O}_2 + \text{Cl}_2 + \text{aq.} = \text{Ba(OCl)}_2 \text{ aq.} + 179,420$ cal. The heat of formation of the following salts in aq. soln. is $\text{NaCl aq.}, 96,514$ cal.; $\text{KCl aq.}, 99,424$ cal.; $\text{LiCl aq.}, 105,971$ cal.; $\text{CaCl}_2 \text{ aq.}, 208,404$ cal.; $\text{SrCl}_2 \text{ aq.}, 208,938$ cal.; $\text{BaCl}_2 \text{ aq.}, 207,062$ cal. The heat of formation of gaseous Cl_2O is $-16,239$ cal., and that of $\text{Cl}_2\text{O aq.}$ is $\text{Cl}_2 + \frac{1}{2}\text{O}_2 + \text{aq.} = \text{Cl}_2\text{O aq.} - 7,502$ cal.

S. LENHER

Mathematical determination of the heat of combustion of gaseous saturated hydrocarbons and their mixtures. JAROSLAV HOŠEK *Chem Obzor* 4, 105-7, 197-200 (200-1 English) (1929).—The values of the heats of combustion of the first 5 hydrocarbons, CH_4 - C_5H_{12} , form an arithmetical series in which the difference, d , is 158,680 cal. On the basis of the additive properties of CH_4 homologs, the heat of combustion of $\text{C}_n\text{H}_{2n+2}$ is caled. For heat of combustion of 1 cu. m. of a mixt. of CH_4 with its first 4 homologs at temp. 18° and 750-mm Hg the following equation was derived: $Q = 10^6(V_1 - d)/O + d \text{ CO}_2/O_e$ cal., where V_1 = combustion heat of CH_4 , d , the av. difference of combustion heat of the members of the homologous series, CO_2 = the no. of cc. of CO_2 formed by combustion of 1 cu. m. of gaseous mixt., O_e = mol. vol. of CO_2 in cc. and O = the av. mol. vol. of the first 5 paraffin homologs in cc. under the conditions given. Substitution gives the equation: $Q = 2,262,874 + 6,6002 (\text{CO}_2)$ cal./cu. m. For calcn. of combustion heat and heating power of 1 cu. m. of mixts of gaseous paraffins with other inflammable gases, the following formulas were derived: $Q = 51,017.18 \text{ H}_2\text{S} + 139,068.65 \text{ C}_2\text{H}_4 + 319,397.64 \text{ C}_2\text{H}_6 + 28,122.21 \text{ CO} + 28,307.56 \text{ H}_2 + 22,628.74 \text{ C}_n\text{H}_{2n+2} + 2 + 66,002.00 \text{ CO}_2$ cal.; $W = 46,357.86 \text{ H}_2\text{S} + 129,788.56 \text{ C}_2\text{H}_4 + 17,928.39 \text{ C}_n\text{H}_{2n+2} + 2 + 305,575.72 \text{ C}_6\text{H}_6 + 28,122.21 \text{ CO} + 23,706.06 \text{ H}_2 + 61,366.7 (\text{CO}_2)$ cal., in which the symbols: H_2S , $\text{C}_n\text{H}_{2n+2}$, etc., mean the volumetric percents of the gas present in the mixt., (CO_2) the no. of cc. CO_2 formed by combustion of satd. hydrocarbons from 100 cc. of the gas. The reliability of these equations and the possibility of their practical application was tested by 16 examples. The deviations of calcs. from the measured quantities were in the limits $0.00002 - 0.47\%$; they were larger with CH_4 and its mixts.; otherwise they scarcely amounted to 0.1% . Their use for detn. of combustion heat of the products of hydrogenation of C compds., low-temp. carbonization, etc., will be important.

JAROSLAV KUČERA

Thermal reaction between potassium oxalate and mercuric chloride. W. E. ROSEVEARE AND A. R. OLSON *J. Am. Chem. Soc.* 51, 1716-24 (1929). The rate of soln. for the thermal reaction $2\text{HgCl}_2 + \text{C}_2\text{O}_4^{--} = \text{Hg}_2\text{Cl}_2 + 2\text{Cl}^- + 2\text{CO}_2$ (in absence of O_2) is first order in respect to HgCl_2 , 2nd order in respect to Cl^- and $\text{C}_2\text{O}_4^{--}$. O is a neg. catalyst which also affects the order in respect to $\text{C}_2\text{O}_4^{--}$. Fe^{++} , which is a pos. catalyst, has a similar effect. The total expression is given for the rate, which holds good at all concns in neutral soln.

F. R. BICHOWSKY

Calorimetric determination of the heat of adsorption. A. MAGNUS AND H. GIEBENHAIN. *Z. physik. Chem., Abt. A*, 143, 265-77 (1929). A very sensitive calorimeter is used for measuring directly the heat of adsorption at low pressures, 0.23 to 122 mm., of CO_2 on SiO_2 gel and on purified C at 0° and 25° . The heat of adsorption per mol. of CO_2 adsorbed increases somewhat with decrease in pressure, and is higher at 0° than at 25° . The data are given in graphic and tabular form.

F. D. ROSSINI

Heat effects in the formation of dispersed systems. II. The heat of wetting of powders by solutions of surface-activating agents and the heat of adsorption in solutions. P. REHINDER AND I. KRAYUSHKINA. *Z. physik. Chem., Abt. A*, 142, 282-8 (1929); cf. *C. A.* 22, 708.—Measurements were made of the heats of wetting and the heats of adsorption of isoamyl alcohol in aq. soln. by charcoal, and of butyric acid in H_2O and in hexane by SiO_2 gel and by charcoal. The alc. and acid are surface-activating agents of which very small concns. greatly change the angle of contact between the solid and liquid surfaces. For hydrophilic powders, the heat of wetting increases with the dielec. const. of the pure wetting liquid, while for hydrophobic powders the opposite is true. For the latter, e. g. ores and charcoal, the heat of flotation is pos. The heat of adsorption is smallest in adsorption from the solvent of which the heat of wetting is greatest. The differential heat of adsorption always decreases to zero as the concn. of the activating substance increases.

H. F. JOHNSTONE

The determination of depolarization of the Tyndall beam as a working method in colloidal chemistry (LANGE, EITEL) 8. Nomenclature of organic chemistry (HOLLMAN) 10. Chemical valence and spectrum multiplicity (WILLIAMS) 3.

3—SUBATOMIC PHENOMENA AND RADIOCHEMISTRY

S. C. LIND

The story of the chemical elements. ARTHUR A. NOYES. *Science* 69, 19-27 (1929).—Retiring president's address. F. N. SCHOTT

Note on the condensation of radioactive substances on solid surfaces. G. H. HENDERSON. *Proc. Cambridge Phil. Soc.* 25, 344-6(1929).—It is noted that instead of being localized in a single spot radon condensed on to a Cu target cooled in liquid air, spread over the entire surface. The fact is explained on the basis of the emanation atoms being adsorbed but for a short time and then flying off again. Po deposits show somewhat the same effect, the Po being distributed in intensely active spots; the purity of the surface undoubtedly plays a very important part in detg. the size of the aggregates. WILLIAM E. VAUGHAN

The corpuscular properties of light. ARTHUR H. COMPTON. *Naturwissenschaften* 17, 507-15(1929)(In English).—A review with references. B. J. C. VAN DER HOEVEN

Absorption of light by some organic substances. L. MARCILEWSKI AND O. WYROBEK. *Bull. intern. acad. Polonaise* 1929A, 93-110(In English).—Absorption bands of several org. substances are analyzed. Pyridine in aq. soln. shows 3 bands having maxima at λ 2620, 2570 and 2510 Å. Quinoline in alc. soln. shows 4 bands with maxima at 3135, 3069, 3000 and 2780, the last band being very broad. The intensity is almost equal for both bases. Phenylacetic acid (I) gave an entirely different result from benzoic acid studied previously (cf. C. A. 21, 358). Three distinct bands on a narrow space characterize its spectrum, which remains unaltered by substitution of the H atoms of the CH_2 group by such groups as OH or C_2H_5 . Therefore phenylglycolic acid (II) and benzilic acid (III) cause spectra similar to that of I. In all cases the maxima are at the same wave length, viz., 2645, 2580 and 2530 Å. U., but the intensity of absorption increases in the order II, I, III. The absorption of menthone differs markedly from that of menthol. The former shows bands with maxima at 2800 and 2550 of equal intensity, probably due to the ketone group, while menthol absorbs continuously. Probably the cycloparaffins do likewise. Benzil absorbs very strongly, max. at 2590. Tribromophenol absorbs similarly to phenol but much more strongly and the max. is shifted toward the less refrangible end, the phenol. max. being 2608, whereas that of tribromophenol is at 2660. J. WIERTELAK

The structure of the AX_4 group. A. M. TAYLOR. *Trans. Faraday Soc.* 25, 314-6 (1929). Regarding the distribution of electrons, the AX_4 group seems to be composed of atoms linked by semi polar bonds. The mechanical interactions between the atoms can be described by a model that is ionic. The electrons shared by two atoms appear to be more effective in screening the O atoms than in screening the central atom, so that in any mechanical disturbance, the binding is approx. electrostatic. Of the two vibration frequencies found in the infra red spectra of silicates, sulfates, chromates, selenates, permanganates and perchlorates, one varies but little from substance to substance, and may be considered chiefly due to vibrations of the O atoms. The other varies, and may be ascribed to vibrations of the central atom. MERRILL W. SEYMOUR

The mass ratio of proton and electron. REINHOLD FÜRTH. *Naturwissenschaften* 17, 688-9(1929). A relation is sought between the two dimensionless nos. of about 1000 viz., $\frac{e}{mc} = \frac{1}{137}$ and $\mu = \frac{m_p}{m_e}$. It is assumed that a light quantum can give a proton or an electron (reverse of Eddington process) of $r_p + r_e = \lambda$. From the energy equations and charge distribution follows for $\mu = k\lambda - 2$ or 1 ($k\lambda - 2$) in which k is a charge-distribution const. From $\lambda = 861.5$ and a continuous charge distribution over the particles (Schrödinger charge cloud) with $k = 12$ a value for $\mu = 1836$ is found (1846 actual). B. J. C. VAN DER HOEVEN

Nuclear charge and photon migration. EGON WIERG. *Z. physik. Chem., Abt. A*, 143, 97-118(1929). A simple rule has been found to account for the direction of those chem. reactions which depend upon the exchange of H. According to the octet theory the direction of the reaction depends upon the direction of migration of a proton which dissociates from one of the atom groups. The rule states that the proton migrates only from the atom with larger nuclear charge to the atom with smaller nuclear charge. It is thus possible to explain a large number of chem. facts, such as acidity or basicity, the hydrolysis of salts and the stability of NH_4 compds. C. J. H.

Experimental evidence for the filling of electron levels from the relative intensity of x-ray spectrum lines. SAMUEL K. ALLISON. *Phys. Rev.* **34**, 7-16(1929).—According to the accepted theory of the periodic system electrons first enter the 5i orbits at 57 La, only one electron remaining in these orbits until 72 Hf, from whence the orbits fill up to 10 electrons at 79 Au. The $L\beta_1$ line is double representing the transitions $5_{3/2} \rightarrow 5_{3/2}$. In a previous paper (*C. A.* **22**, 3580) it was shown that this line was much more intense in the U than in the W L series. The present paper reports intensity measurements involving this line in 76 Os, 77 Ir, 78 Pt, 79 Au, 81 Tl, 82 Pb, 83 Bi. Exptl. difficulties due to deposition of W on the targets from the filaments may be avoided by high vacua. A curve showing the intensity ratio β_1/β_2 as a function of the at. no. rises with increasing at. no. and takes an upward jump between 78 Pt and 79 Au. This indicates that the first element in which 10 electrons occupy 5i orbits is an approx. undisturbed condition in the solid state is 79 Au. B. L.

Diatomic molecules according to the wave mechanics. I. Electronic levels of the hydrogen molecular ion. PHILIP M. MORSE AND E. C. G. STEUCKELBERG. *Phys. Rev.* **33**, 932-47(1929).—The electronic energies of the H mol. ion are calcd. by means of the wave mechanics as functions of the nuclear sepn for several values of quantum nos. The first-order perturbations of the electronic energies of the first three degenerate levels of the He ion were calcd., the perturbation being the slight sepn. of the nuclei. The first-order perturbations of the first two degenerate levels of the H atom for infinite sepn. were calcd. when the perturbation was the diminution of the sepn. The electronic energies plus the energy of nuclear repulsion give the mol. potential energies. A calcn. of these shows that of the 8 curves obtained only 3 states show minima and therefore are stable configurations to this order of approximation. The numerical results check with previous calcn. and with the data available. **II. Vibrational levels.** PHILIP M. MORSE. *Ibid.* **34**, 57-64. —An exact soln. is obtained for the Schroedinger equation representing the motions of the nuclei and a diatomic mol., when the potential-energy function is assumed to be of a form similar to those required by Heitler and London (*C. A.* **21**, 3542) and others. The allowed vibrational-energy levels are given by the formula $E(n) = E_e + h\omega_e(n + \frac{1}{2}) - h\omega_e x_e(n + \frac{1}{2})^2$, which is known to express the exptl. values accurately. The empirical law relating the normal mol. sepn. r_0 and the classical vibration frequency ω_0 is shown to be $\omega_0^3 r_0 = K$ to within a probable error of 4%, where K is the same const. for all diatomic mol. and for all electronic levels. By means of this law and by means of the soln. above, the exptl. data for many of the electronic levels of various mol. are analyzed and a table of const. is obtained from which the potential-energy curves can be plotted. The changes in the above-mentioned vibrational levels due to mol. rotation agree with the Kratzer formula to the first approximation. BERNARD LEWIS

The effective cross section of heavy noble gases relative to electrons below one volt. C. RAMSAYER AND R. KOLLATH. *Naturwissenschaften* **17**, 671(1929). Two curves are given of effective cross section (sq. cm. per cu. cm. at 0° and 1 mm. Hg. electron speed (0 to 2 e.v.) and its square root (0 up to 6) for Xe, Kr and Ar. All three show a min. at about 0.7 v., steep rise towards lower voltage, more gradual rise at higher speeds, with a max. between 6 and 10 v. B. J. C. VAN DER HOEVEN

The dispersion electrons in the one-electron problem. J. HARGREAVES. *Proc. Cambridge Phil. Soc.* **25**, 323-30(1929).—The Kramers-Hersenberg dispersion formula for an atom with 1 electron is derived by the use of Dirac's relativity quantum mechanics. From the dipole moment due to incoherent scattering, it is found that the no. of dispersion electrons for any state of the atom is not exactly unity. A. F.

The quantum theory of electron scattering by helium. N. F. MOTT. *Proc. Cambridge Phil. Soc.* **25**, 304-9(1929).—By using Hartree's fields and Born's approximations, an equation for elastic scattering in helium is derived from the quantum theory. The equation agrees with the exptl. results (cf. Dymond and Watson, *C. A.* **22**, 1273) much better than the equations of the classical theory. ARTHUR FLEISCHER

The quantum mechanics of chemical reactions. R. M. LANGER. *Phys. Rev.* **34**, 92-108(1929).—The quantum mechanics is capable of describing processes which have all the aspects of certain chem. reactions. A system may change from one configuration to another when a quantum level of the one configuration has the same energy as the quantum level of the other. Among such reactions mention is made and some discussion is given of the large class of mol. rearrangements and decomps. including radioactive disintegration. The dependence on pressure and temp. is slightly discussed and it is indicated that the present theory explains the necessity of the activation hypothesis of Arrhenius. The old notions should, however, be modified to take into

account that it is not sufficient to have at least the "activation energy," but the mol. must be in a particular state to react. Moreover, when there are several activated states the rate of reaction from different ones may be very different indeed. Insight is gained into the nature of certain types of catalytic action including special wall catalyses. The theory attempts to make clear some features of photochem. reactions.

BERNARD LEWIS

Unimolecular reactions. D. G. BOURGIN. *Proc. Natl. Acad. Sci.* **15**, 357-62 (1929).—Math. An exposition wherein B. considers the problem of unimol. reactions on the basis of new quantum theory concepts, using a treatment analogous to the recent work on thermionic emission and radioactive disintegration. Upon simplification by assumptions there is obtained an "Arrhenius" type of formula. It is pointed out that the method of the paper offers a means of estg. the equil. point. LOUIS S. KASSEL. *Ibid* 601-3.—A criticism of Bourgin's attempt to apply new quantum mechanics to the problem of unimol. reaction rates. In particular is criticized his assumption of a potential-energy function similar to that applied to an α -particle in a radioactive nucleus. K. points out that the probable process of dissoen. is a radiationless quantum jump from a level in the discrete spectrum of the mol. to one in the continuous spectrum.

WILLIAM E. VAUGHAN

The distribution of charge in the chlorine ion in rock salt. G. W. BRINDLEY. *Phil. Mag* [7], **7**, 616-23 (1929).—The exptl. and theoretical values of the x-ray scattering factor for the Cl ion differ by an amt. greater than can be attributed to exptl. error for values of $(\sin \theta / \lambda)$ of the order of 0.4-0.5. It is assumed that this difference is due to a change in the radial distribution of the charge on the ion. Radial Fourier analysis of the difference between exptl. and theoretical scattering factors has been applied to the calcn. of the difference between the charge distribution in a free Cl ion as detd. by Hartree (cf. *C. A.* **22**, 1269) and in a Cl ion in a rock-salt lattice. The results are employed to det. the charge distribution in a Cl ion in rock salt. I. H. REVERSON

Influence of bromine vapor on the mobility of the positive and negative ions in hydrogen and oxygen. HERBERT MAYER. *Bull. Fac. Stiinte Cernauti* **2**, 65-83 (1928); *Physik. Ber.* **9**, 2000.—Neg. ions are strongly affected by traces of Br; pos. ions are negligibly affected. In general the results obtained with Br agree with those obtained with Cl, except that more Br than Cl is required to produce a similar effect. The Lenard theory quant. explains the results.

ALBERT L. HENNE

Perturbations in molecules and the theory of predissociation and diffuse spectra. OSCAR K. RICE. *Phys. Rev.* **33**, 748-59 (1929).—When the discrete vibration-rotation absorption bands connected with transitions to a certain final electronic state of a mol. overlap the continuous region for the transitions to another final electronic state, some of the discrete bands may be diffuse, i. e., the rotation bands may be broad and blur into each other. The broadness of the lines has previously been assumed to be connected with the short life period of a mol. in a discrete state when there is the possibility of its making a radiationless transition to a state of dissoen. The width is directly calcd. by the method of wave mechanics.

BERNARD LEWIS

The detection of dissociation of halogen molecules caused by radiation. HERMANN SEFTLEBEN AND ERICH GERMER. *Ann. Physik* [5], **2**, 847-64 (1929); cf. *C. A.* **21**, 1054. The dissoen. of Cl_2 , Br_2 and I_2 by light was detected by the change of resistance of a heated Pt wire in the reaction chamber. When dissoen. occurred the thermal cond. of the gas increased, causing a decrease in the temp. of the wire, and hence in the resistance. Cl_2 at a pressure of 0.26 mm. showed dissoen. at 4359, 4678, 4680, 4722 but none above 4800 A. U. It was necessary to glow the Pt wire in Cl_2 to poison it to prevent recombination of Cl atoms at the wire. The effect as shown by the galvanometer for Br_2 at 0.25 mm. was much less than for Cl_2 because of the decreased efficiency in poisoning the wire and the increased rate of recombination of Br atoms at the higher concn. at which they were present. Dissoen. of Br_2 occurred below wave lengths of 5086 A. U. For I a quartz vessel, to decrease the rate of recombination of I atoms, had to be substituted for the glass reaction vessel. Dissoen. was found below 5000 A. U. The limiting values of the wave lengths causing dissoen. agree qualitatively with the optically detd. edge of the band spectra of the halogens.

ARTHUR FLEISCHER

The assignment of quantum numbers for electrons in molecules. III. Diatomic hydrides. ROBERT S. MULLIKEN. *Phys. Rev.* **33**, 730-47 (1929); cf. *C. A.* **23**, 26, 2101. The known electronic states of diatomic hydride mols. (MH) are derivable from unexcited H plus familiar low-energy states of M atoms. Observed states and especially observed Δv intervals in ^1H or ^3H states of such MH mols. indicate that the effects of the H on the M atom are confined essentially to the following: (1) the

couplings, when present, between l_r vectors of M atom outer electrons to give a resultant l are completely broken down by the field of the H nucleus; the M atom orbits are otherwise scarcely changed, except for slight shielding or similar effects produced by H electrons and nucleus; the usual l_r selection rules, are however abolished; (2) the uncoupled vectors l_r are separately space-quantized with reference to the elec. axis, giving component quantum nos. i_{er} ; (3) the electron of the H atom ($i_{tr} = 0$) is promoted and takes its place with the M electrons, sometimes becoming equiv. to one of them giving a new closed shell (of 2 electrons); the H nucleus, however, remains on the outer edge of the M electron cloud, so that the hydrides should in general be strongly polar, in agreement with Meche's (C. A. 21, 2225) conclusions; (4) the original coupling of s_r vectors are often broken down by the advent of the H electron spin; the latter alters the original multiplicity by one unit. Data are presented as evidence that mol. stability is primarily a matter of promotion energy, rather than of valence bonds. A simple explanation is given of observed *multiplet widths* $\Delta\nu$ in ^{21}H and ^{21}H states of MH mols. in terms of $\Delta\nu$ values of corresponding M atoms in states resulting from dissoen. of MH. Usually $\Delta\nu_{MH}/\Delta\nu_M$ is a little under $2/3$; the factor $2/3$ is that expected, according to theory, from the space-quantization of l_r 's to give i_{tr} 's. B. L.

Production of pure uranium. ERLING BOTOLFSEN. *Bull. soc. chim.* 45, 626-7 (1929).—See C. A. 23, 4131. E. C. M.

A novel observation in the preparation of radium emanation. KURT PETERS AND KURT WEIL. *Naturwissenschaften* 17, 690(1929). Continuous measurements were made of the γ activity of the Ra prep. and of the Rn obtained during either ignition of (Ra,Ba)SO₄ *in vacuo*, evacuation of a NaCl KCl melt contg. RaCl₂ or aeration of a boiling Ra soln. On freezing out the Rn at -185° the condensate shows an initial strongly penetrating γ radiation, which increases only slowly and drops rapidly (to only $1/10$) on interrupting the condensation process. The Ra prep. shows the reverse: a rapid decrease of γ activity in the first 2 min. and a rapid increase on interruption. The affect is of the order of 1% of the total γ activity of normal Ra, its carrier is not absorbed by cottonwool filters or long glass tubes; it is not an adsorption effect. The life period of the γ radiation observed is about 1 min. Possibility of impurity in the original Ra is not quite excluded. B. J. C. VAN DER HOEVEN

Absorption of high-frequency radiation. E. C. STONER. *Phil. Mag.* [7], 7, 841-58 (1929).—S gives a revised estimate of the intensities of γ -rays of Ra B and Ra C using the results of Ellis and Wooster (cf. C. A. 19, 1813, 3121; 21, 2123) on β -rays and the heating effect of γ -rays. These results show that the no. of impulses observed by Kovarik is greater than the number of γ ray quanta emerging from the disintegrating atoms. By using the results of Ahmad (cf. C. A. 18, 3312, 20, 145) on the absorption of γ -rays a deduction of the γ -ray absorption coeffs. is made. The values agree closely with those calcd. from the formula of Klein and Nishina (cf. C. A. 22, 4371). Some anomalous results of Ahmad appear to be due to secondary scattering effects. Exptl. arrangements for more precise tests of the formula are suggested. The Klein-Nishina formula indicates that the most penetrating cosmic radiation observed by Millikan and Cameron corresponds to the electron-proton annihilation wave length. L. H. R.

High-frequency discharges in gases. J. S. TOWNSEND AND W. NETHERCOT. *Phil. Mag.* [7], 7, 600-16(1929).—The authors describe methods for the detn. of the relations which exist between the e. m. f. and the current in high frequency discharges. Expts. were made with continuous-current and high-frequency discharges in N. The results agree with the theory of T. (*Compt. rend.* 186, 55(1928)). L. H. R.

High-frequency discharges in helium and neon. R. L. HAYMAN. *Phil. Mag.* [7], 7, 586-96(1929).—When a const. oscillation frequency is maintained in cylindrical discharge tubes of fixed diam. there is a certain pressure at which there is a min. starting potential. This minimum potential increases with the distance between the electrodes and decreases with increasing tube diam. There is a certain pressure for He and Ne at which there is a min. potential required to maintain the discharge. The maintenance potential increase is directly proportional to the pressure. The starting potentials increase with the wave length for pressures up to 6 mm., while above this they are nearly const. for all wave lengths from 40 to 640 m. As the wave lengths change the maintenance potential varies in such a manner as to indicate that it is composed of two parts: (1) the potential fall in the gas column which is under a uniform elec. force, independent of the wave length, and (2) the potential drop at the electrodes which is independent of the length of discharge and approx. proportional to the wave length. The discharge phenomena are all markedly affected by impurities in the gases. L. H. REYERSON

The corona discharge in neon. F. M. PENNING. *Phil. Mag.* [7], 7, 632-3(1929).—

With a wire cathode and a cylinder anode in pure Ne the starting potential for the negative discharge is less than that of the positive discharge. This is contrary to the results of Huxley (cf. *C. A.* 22, 2319). Argon when present in small quantities gives the same results as those of Huxley. Huxley's results offer no evidence against the theory that electrons can be set free from the cathode by the action of positive ions.

L. H. REYERSON

Ions and electrical currents in the upper atmosphere. E. O. HULBURT. *Science* 70, 216(1929).—Gravitational drift currents in the atm. consist of (1) a sheet flowing eastward above 150 km. dividing into 2 sheets at the sunrise and sunset longitudes; (2) one of these flows westward on the day side of the earth below (1), and the other (3) continues eastward on the night side of the earth. The net (eastward) current is given as 2×10^6 amps. As a result the sunset longitude of the earth is at a potential several hundred volts above the sunrise longitude; this with the earth's magnetic field causes an upward drift of ions on the night side, partially compensated by cooling contraction, probably causing a net rise of the Kennelly-Heaviside layer. G. M. E.

Space-charge sheaths in positive-ray analysis. R. W. GURNEY AND P. M. MORSE. *Phys. Rev.* 33, 789-99(1929).—In the usual ionizing chambers used in the positive-ray analysis of secondary ion products a positive sheath is formed, which concentrates the field applied across the chamber into the portion of the chamber next to the slit, leaving the rest of the space field-free. A modification of the usual app. was used to check this fact. The sheath thickness varies with the voltage applied across the chamber, the electron current and the pressure, and inasmuch as some ions are formed best in a field-free space, and some best in a field, by varying any of the 3 variables, one changes the relative proportions of the various secondary and net primary ions reaching the analyzer collector. Curves are given for the sheath thickness and for the various ionic currents through the slit for several conditions in the chamber, and these curves are checked with data given by several observers. This analysis shows the complexity of the phenomenon and indicates modifications in the exptl. procedure which may help to clarify the interpretation of exptl. results.

BERNARD LEWIS

Determination of the charge of positive thermions from measurements of shot effect. N. H. WILLIAMS AND W. S. HUXFORD. *Phys. Rev.* 33, 773-88(1929).—Several new types of current fluctuations have been studied with special reference to the possible effects of both positive ions and electrons, and the influence of space charge. An emitter of positive K ions is described which has proved suitable for shot effect measurements. Results indicate that the discharge may be properly controlled and temp.-limited current obtained giving a value for K^+ ion equal in magnitude to the electron charge. Values resulting from an extensive series of detns. of electron charge confirm the precision and expediency of several new methods which have been introduced into the exptl. procedure. A detailed description is given of a *simple and direct method of detg. the shot circuit impedance.*

BERNARD LEWIS

A test for polarization of electron waves by reflection. C. J. DAVISSON AND L. H. GERMER. *Phys. Rev.* 33, 700-72(1929); cf. *C. A.* 23, 1346.—A homogeneous beam of electrons is directed at 45° incidence against a {111} face of Ni crystal. The beam is twice reflected and the electrons, which have lost practically no kinetic energy in the reflections, are collected in a Faraday collector. Measurements of the intensity of the twice reflected beam have been made at bombarding potentials from 10 to 200 v. Within this range selective reflections (intensity max.) are observed at 20, 55, 77, 103 and 120 v. These 5 selectively reflected beams have been separately tested for polarization by measuring the current received by the collector as a function of the azimuth of the movable system. Observations show that *electron waves are not polarized by reflection.*

BERNARD LEWIS

Electron waves and their use in analysis of crystal structure. E. RUPP. *A E G Mt.* 1929, 535-41; cf. *C. A.* 23, 4880.—A review of the development of the wave theory of light and the analogous wave theory of electrons is given. X-ray spectroscopy, based on the latter theory, and some of its applications are considered: structure of space lattice, analysis of surfaces, adsorbed layers and surface reactions.

M. McMAHON

Application of Talbot's law to photoelectric cells with a non-linear illumination current characteristic. G. H. CARRUTHERS AND T. H. HARRISON. *Phil. Mag.* [7], 7, 322-320(1929).—A simple analysis is given to show that Talbot's law should be valid for a cell in which the photoelec. current is proportional to illumination, but should fail where such proportionality does not exist. A series of careful expts. shows, however, that Talbot's law holds for both types. An explanation of these results is given.

L. H. REYERSON

Variation of the photoelectric effect with temperature and determination of the long wave-length limit for tungsten. A. H. WARNER. *Phys. Rev.* **33**, 815-8(1929).—The surface is rendered insensitive at room temp. by traces of gas, but regains its sensitivity between 800° and 900°K. The long wave-length limit is $\lambda_{2570} \pm 50$ Å. U.; it is independent of temp. BERNARD LEWIS

Maximum excursion of the photoelectric long-wave limit of the alkali metals. HERBERT E. IVES AND A. R. OLPIN. *Phys. Rev.* **34**, 117-28(1929).—Previous expts. (Ives, *C. A.* **19**, 603) have shown that the long-wave limit of photoelec. action in the case of thin films of the alkali metals varies with the thickness of the film. A max. value is attained greater than that for the metal in bulk, which for the majority of the alkali metals lies in the infra-red. The wave length of the max. excursion of the long-wave limit was first studied for Na, K, Rb and Cs. In each case it coincides with the first line of the principal series, i. e., the resonance potential. If this relation holds for Li, its max. wave limit should be greater than that of Na. Expt confirmed this, use being made of red-sensitive films sensitive to 0.6708 μ . It is suggested that photoelec. emission is caused when sufficient energy is given to the atom to produce its first stage of excitation. The identity of photoelec. and thermionic work functions suggests that the at. excitation is the initial process in thermionic emission as well. B. L.

Note on R. Suhrmann's hydrogen ions as the cause of the increase of the photoelectric spectral selectivity of potassium. R. FLEISCHER. *Physik. Z.* **30**, 320 2(1929); cf. *C. A.* **23**, 1050.—An important step in the activation of K by H is the clean-up of H by K in the vapor state. F. R. BICHOWSKY

The photoelectric and thermionic properties of molybdenum. MILES J. MARTIN. *Phys. Rev.* **33**, 991-7(1929).—The photoelec. sensitivity of Mo increases as heating progresses, finally reaching a limiting value. This was accompanied by a shift in the wave-length limit from approx. 2600 Å. U. to approx. 3800 Å. U. The photoelec. work function of Mo is 3.22 ± 0.16 v. and the thermionic work function 3.48 ± 0.07 v. The photoelec. sensitivity of Mo increases with temp., approx. 30% between room temp. and 1000°. BERNARD LEWIS

An ionization spectrometer for long-wave Röntgen rays. H. KULENKAMPFF AND B. WOERNLE. *Physik. Z.* **30**, 551-4(1929). L. J. C.

The mechanism of the Geiger chamber. Determination of the intensity ratio of the M_{α} and M_{β} lines of tungsten. KURT MOLIN. *Arkiv Mat. Astron. Fysik* **21A**, 1-22(1929). W. F. MEGGERS

Change of frequency of x-rays scattered by bound electrons. DANA P. MITCHELL. *Phys. Rev.* **33**, 871-78(1929).—This paper describes an investigation following the discovery of fine structure in scattered x-rays by Mitchell and Davis (*Phys. Rev.* **31**, 1119(1928)). Mo K_{α} x-rays were scattered at about 90° by graphite, Al and Be. Lines from graphite were shifted 0.0013, 0.0023 and 0.0113 Å. U. to the long wave-length side of Mo K_{α} . From Al the shifts were 0.0023, 0.0055 and 0.009 Å. U. to the long wave-length side of Mo K_{α} . From Be the shifts were 0.0048 Å. U. to the long wave-length side and 0.00065 Å. U. to the short wave length side of Mo K_{α} . Graphite shifts for scattering angles of 42° and 147° were the same as for 90°. This and all curve widths establish the fact that the scattering electrons were ejected with zero kinetic energy. Hence the energy relation is $h\nu' = h\nu + V$. From this the critical potentials 32, 57 and 279 v. are obtained for C; 57, 136 and 1559 v. for Al; and 16 and 119 v. for Be. BERNARD LEWIS

Compton modified line structure and its relation to the electron theory of solid bodies. JESSE W. M. DU MOND. *Phys. Rev.* **33**, 643-58(1929).—The structure of the Compton line was obtained for a scattering angle of nearly 180° with specially designed tube contg. a metallic Be scatterer. The diffuse structure of the Compton line is attributed to a broadening caused by the velocity distribution of the scattering electrons in the solid scatterer analogous to a Doppler broadening and a relation between line structure and velocity distribution is derived. The results strongly contradict the classical distribution of electron velocities in solid bodies predicted by the rigid interpretation of the Maxwell-Boltzmann equipartition law. They are also in contradiction with the older Bohr-Sommerfeld atom model. The results are in accord with the wave-mech. atom model and constitute favorable evidence for the Sommerfeld distribution of metallic electron velocities and for the degenerate gas state. BERNARD LEWIS

Fine structure in the Compton effect. BERGEN DAVIS AND HARRIS PURKS. *Phys. Rev.* **34**, 1-6(1929); cf. *Phys. Rev.* **31**, 1119(1928); *C. A.* **23**, 765.—The displaced scattered radiation from C (pure graphite) and Be was investigated. A special x-ray tube was constructed with the scattering element near the target. The displaced radiation from C has fine structure as follows going toward long wave lengths: A relatively strong

line 0.0421 A. U. from Mo $K_{\alpha 1}$ position, and 3 weaker lines at 0.0012 A. U., 0.002 A. U. and 0.0109 A. U. from the strong line. These agree closely with fine-structure lines previously found. The two pictures are alike, but the displaced one is shifted 0.0421 A. U. from the undisplaced. The displacement is less than is to be expected from $d\lambda = 0.0243 (1 - \cos \theta)$. These results give $d\lambda = 0.022 (1 - \cos \theta)$, which is 9% less than is to be expected from theory. In the scattered radiation from Be a strong main line was found at 0.0446 A. U. = 0.0228 $(1 - \cos \theta)$ from the Mo $K_{\alpha 1}$ position, and a line at 0.0051 A. U. toward the long wave lengths from the main line. This displacement is near the value to be expected from Be K energy level. A weak line at 0.0009 A. U. toward short wave lengths from the main line also was found. These two lines were found by Mitchell in the undisplaced scattering from Be and were ascribed to the K and L_1 energy levels of Be. The L_1 line, however, was shifted 0.00058 A. U., which is much less than the 0.0009 A. U. found here in the displaced spectrum. B. L.

Diffraction of x-radiation from some crystalline aggregates. STERLING B. HENDRICKS. *Z. Krist.* **71**, 269-73 (1929). It is shown that x-ray photographs obtained from heated mica sheets and from kaolinite crystals can be explained on the basis of a space lattice diffraction from a particular type of crystal aggregation rather than by means of a postulated two-dimensional lattice. Cf. *C. A.* **23**, 4138. L. S. R.

Diffraction of x-rays in liquids: benzene, cyclohexane and certain of their derivatives. G. W. STEWART. *Phys. Rev.* **33**, 889-99 (1929); cf. *C. A.* **23**, 764.—An examn. by the x-ray diffraction method was made of benzene, toluene, *o*-, *m*- and *p*-xylene, mesitylene, ethylbenzene, isopropylbenzene, cyclohexane, methylcyclohexane, *o*-, *m*- and *p*-dimethylcyclohexane, phenol, aniline, cyclohexanol, cyclohexanone, 2-hydroxy-1,3-dimethylbenzene, *o*-, *m*- and *p*-toluidine and *o*-, *m*- and *p*-cresyl methyl ether. The diffraction peaks are taken to be caused by the semi-orderly space arrangement of the mols. in the liquid or cybotactic condition, and the distances of sepn. of the plans cont. diffraction centers are computed by Bragg's diffraction law. The benzene and cyclohexane rings are shown to be flat, having thicknesses of 4.70 A. U. and 5.10 A. U., resp. The general dimension in a plane perpendicular to the thickness is indicated by a diam. of approx. 6 A. U. as indicated by an area of 31.4 sq. A. U. for benzene and 55.2 sq. A. U. for cyclohexane. The evidence is in favor of the maintenance of the general shape of the benzene and cyclohexane rings as units of structure. The general correctness of the ring conception is indicated by the similarity of the thickness to the diam. of paraffin, alc. and fatty acid chains. The thicknesses of the benzene and cyclohexane "rings" depend upon the relative positions of the substituents. Evidence obtained by a semi-orderly arrangement of mols. with diffraction centers in planes sepd. by a distance of the magnitude of two mol. lengths indicates that 6 compds. having the substituent OH with one a cyclohexane deriv. show "double" mols. produced by the juxtaposition of the two OH groups. None of the others showed this type of orientation. Ten compds. gave an additional set of planes due to the position rather than to the nature of the substituents. Of these three the hydroxydimethylbenzenes showed the three sets of planes, one corresponding to the ring thickness, one to an arrangement in a perpendicular direction caused by the substituents and one perpendicular to the other two sets corresponding to the double mol. of the polar groups. B. L.

The scattering power for x-rays and the electron-distribution of the H^- ion. I. M. BLINGER AND W. A. FREDERICKSE. *Rev. trav. chim.* **48**, 1041-6 (1929); cf. *C. A.* **16**, 3779, **19**, 421. The results are presented of a quant. investigation on the diffraction intensities of LiH. The LiH crystal is of the rock-salt form and the H is in the ionic state. These facts as well as the sharp decline in scattering power with increasing diffraction angle are known from previous work. This decline in scattering power constitutes the data from which the distribution of the electrons in the atom can be found. Comparison of the exptl. decline with those calcd. for distributions based on the Bohr model and on the at. model of the quantum mechanics shows a more satisfactory agreement with the latter. C. J. HUMPHREYS

The x-ray K absorption spectrum of chlorine compounds in aqueous solution. OTTO SEIBLING. *Naturwissenschaften* **17**, 689 (1929).—By using an aq. absorption film between 2 rubber films in a vacuum spectrograph, 3 hrs.' exposure, the following wave lengths of the absorption edges were found for solid and dissolved salts, resp.: NaCl 4383.9, 4385.2; KCl 4385.1, 4386.3; HCl, 4385.4; KClO₄ 4376.7, 4376.6. The solns. were almost satd. (HCl 5 N). It is noted especially that in soln. a difference between KCl and NaCl occurred. B. J. C. VAN DER HOEVEN

Some secondary phenomena in x-ray spectra. F. K. RICHTMYER. *J. Franklin Inst.* **208**, 325-61 (1929).—It is proposed to account for the satellites of x-ray lines on the possibility that they originate in 2-electron jumps between multiply ionized

states. If an atom has become doubly ionized by losing an electron from one of its inner "i" shells and also one from an outer "o" shell, then a quantum of energy $h\nu_i$ is emitted when an electron falls from a neighboring shell to the vacant place in the "i" shell, and a quantum $h\nu_o$ when a valence electron falls into the vacant place in the "o" shell. If both jumps occur simultaneously a single quantum of energy $h\nu_s$ is radiated where $h\nu_s = h\nu_i + h\nu_o$. The line of frequency ν_s is then the satellite of the parent line of frequency ν_i . The continuous spectrum which is part of the satellite structure is accounted for on the assumption that the vacant place in the "o" shell is taken by a free electron, kinetic energy $\frac{1}{2}mv^2$. C. C. KIESS

An x-ray method for the spatial measurement of defects in materials. C. KANTNER AND A. HERR. *Z. Ver. deut. Ind.* 73, 811-6(1929).—App. is described by which the dimensions and character of defects concealed in metal or other material can be detd. by a method of making stereoscopic x-ray photographs with different orientations of the specimen. Graphic diagrams are made from these photographs by aid of a densograph, to supplement visual observation. It is expected that the app. will be suitable for industrial use not only in the detection of defects but also in the comparison of those properties of materials which can be studied by aid of x rays. C. J. H.

Refractive indices and anomalous dispersion of soft x-rays in platinum, silver, calcite and glass. ELMER DERSHEM. *Phys. Rev.* 33, 659-71(1929). cf. C. A. 22, 3096, 23, 4405.—Curves are obtained relating the values of $1 - \mu = \delta$ (μ being the index of refraction) with the corresponding wave length λ . The effects of anomalous dispersion are shown in lowered values of δ on both sides of an absorption limit wave length. In calcite this depression in the curve extends over the region from 2.5 to 3.4 A. U., i. e., from frequencies 12% greater to frequencies 10% less than that of the K limit of Ca at 3.06 A. U., a min. value of δ occurring precisely at 3.06 A. U. The dispersion curves for Pt and Ag show that in cases where the C' frequency difference between adjacent absorption limits is small the depression due to the sep. limits are not resolved. The relative frequency sepn. of the L_{II} and L_{III} limits of Ag is less than that of L_I and L_{II} limits; hence two min. or points of inflection appear in the dispersion curve, one at a mean of the L_{II} and L_{III} wave lengths and the other at the L_I limit. This is reversed in the case of Pt. Similar results are found in the M series of Pt. The dispersion curve for glass passes through min. at the K limits of Si and Al, showing that a sample contained the latter element as well as the former, but its compn. was otherwise unknown. These results fully reveal for the first time the type of anomalous dispersion occurring in the region of the K, L and M absorption discontinuities. In general the values of δ are in fair but not excellent agreement with those computed from the Drude-Lorentz dispersion formula for regions not too close to an absorption limit. The form of curve obtained was the same regardless of the particular sample used but the actual values found for δ appear to vary considerably with thickness of film and surface conditions. BERNARD LEWIS

The effect of chemical combination on the absorption of x-rays at wave lengths on each side of the K discontinuity. C. L. COTTRELL. *Phys. Rev.* 33, 879-88(1929).—The difference in the absorption of x-rays by I in the free state as compared with that of I in the chemically combined state was investigated for wave-length bands on each side of the K absorption limit of this element. The double ionization chamber method was used and the x-ray bands were obtained by voltage control and filters. On the long wave-length side of the K limit, the absorption coeff. of the free I atom is about 0.3% greater than that of the combined atom, while on the short wave length side the reverse effect is found to the extent of 0.5%. In Ag the absorption coeff. of the chemically free Ag atom as reduced from AgCl by sunlight, seems to be greater than that of the combined Ag atom in the AgCl before reduction, for wave lengths on each side of the K limit of Ag. BERNARD LEWIS

Approximate method of determining the high-velocity limits of continuous β -ray spectra. J. A. CHALMERS. *Proc. Cambridge Phil. Soc.* 25, 331-9(1929).—By variation of thickness of paper and Al screens between the source and measuring electroscop. C. has detd. from the "kinks" found in the plot of ionizations vs. thickness, the high velocity limit of continuous β -ray spectra. The data for Th (B + C + C'), for Th (C + C') and for Th C' have been found. The breaks are sharp and quite reproducible, indicating a definite end pt. in the absorption, not a tailing-off. The absence of γ -rays from Th C is confirmed. C. discusses several interpretations of the data, with especial attention to dispersion above the high-velocity limit. W. E. V.

Effect of strong magnetic and electric fields on the rectilinear propagation of γ -rays. J. H. J. POOLE AND A. G. CLARKE. *Sci. Proc. Roy. Dublin Soc.* 19, 265-71(1929). Attempts were made to deflect γ -rays from Ra C with first a magnetic field of 18,400

gausses, and then an elec. field of 120,000 v./cm. Neither, however, produced any discernable effect.

The Doppler effect in homogeneous canal rays of hydrogen. WOLFGANG RIEZLER. *Ann. Physik* [5], 2, 429-44(1929).—The velocity of canal rays calcd. from the Doppler effect agrees with the velocity calcd. from the deflection of an elec. or magnetic field. The charged canal-ray particles behind the cathode consist of H^+ , H_2^+ and H_3^+ . A distribution is obtained which approx. corresponds with the Doppler distribution found by Krefit (*C. A.* 18, 3546) in inhomogeneous rays. M. McMAHON

The emission of electrons from metals on irradiation with x-rays. WERNER ESPE. *Ann. Physik* [5], 2, 381-426(1929).—The effects of the following factors on the no. of electrons set free from metals by x-rays are considered: dependence on angle of incidence of x-rays for fast and slow secondary electrons; dependence of emission on roughness of radiated surface, on arrangement no. of radiated metal, on wave length of radiation incidence; dependence of intensity of radiation on voltage of x-ray tube. M. McMAHON

The number of excited atoms and the absorption spectrum of nickel vapor. ADOLFO T. WILLIAMS. *Nature* 124, 373(1929). W. F. MCGGERS

Photodichroism and photoanisotropism. IV. Color adaptation of photochloride. FRITZ WEIGERT AND EVERT ELVEGARD. *Z. physik. Chem., Abt. B*, 4, 239-57(1929); cf. *C. A.* 23, 4146, 4620. The primary photodichroic effect which is shown when layers of gelatin and "photochloride" are exposed to polarized light has been investigated with measurements using monochromatic radiation. Methods of treatment similar to those of the previous work were employed. The exposure radiation was prepd. by use of filters and a monochromator was used to produce the measuring light. Light of wave length from 680 to 500m μ was employed for exposure and varying periods (5 to 240 min) were allowed. Both washed and unwashed plates were treated. Many curves are given, with theoretical discussions. In general it may be stated that the spectral distribution of the dichroism shows that almost all colors of the exposure light will produce a definite color development. It is shown, however, that the curves for long and short wave lengths are different and that there exists a region of relative insensitivity in which the layers are only weakly dichroic. V. Color adaptation in dyestuffs. FRITZ WEIGERT AND M. NAKASHIMA. *Ibid* 258 76.—Methods similar to those above were employed. Twelve different light-sensitive dyestuffs were investigated at various exposure wave lengths and periods of time. It is shown that the light has 2 different effects as is proved by the dichroic curve with polarized light. With weak exposure very sharp color adaptation occurs and the special form of the extinction curve of the dye does not influence the curve. With strong exposure the extinction alone detcs. the curve and a specific effect of the different colors does not enter. The color adaptations are similar to those for photochloride (see above) existing in 2 parts. The results are discussed in detail and curves are presented. The relationship of the new effect to known photochem. characteristics of dyes is considered. WILLIAM E. VAUGHAN

Variations in the spectrum of the light emitted by quartz mercury lamps. TOKUO TAKAHASHI AND L. H. CLARK. *J. Sci. Instruments* 6, 273 7(1929). E. J. C.

The pure rotation spectrum of ammonia. RICHARD M. BADGER AND C. HAWLEY CARTWRIGHT. *Phys. Rev.* 33, 692 700(1929), cf. *C. A.* 22, 2887.—New expl. means for the study of absorption spectra in the extreme infra-red is described. By its use a very simple structure was found for the absorption spectra of NH_3 between 55 μ and 130 μ . Six lines were found which belong to a pure rotation spectrum and are apparently due to changes in the energy of rotation of the NH_3 mol. about an axis normal to the line of symmetry, that is, to transitions in which the quantum no. j increases by unity. Other lines due to transitions with a change also of τ (the quantum no. connected with rotations about the axis of symmetry), are absent. These facts are briefly discussed in connection with the predictions of the wave-mechanics, with which they are shown to be in accord. The moment of inertia of the NH_3 mol. about an axis normal to the line of symmetry is estd. to be 2.77×10^{-40} g. cm.². BERNARD LEWIS

The absorption spectrum of bromine vapor between 6117 Å. U. and 6309 Å. U. MARGARET B. HAYS. *J. Franklin Inst.* 208, 363 9(1929).—The Br absorption bands in the orange and red were photographed with the high dispersion afforded by a 14-ft. concave grating. The source of white light was a 65-watt lamp, of which the rays passed through an 80 cm. layer of Br vapor. The wave lengths derived from measurement of the spectrograms together with the corresponding wave nos., and the quantum no. assignments, are given for each band. C. C. KRESS

Magnesium triplets in arc and solar spectra. MARY E. WARCA. *Publications Allegheny Observatory, Univ. of Pittsburgh* 6, 151-7(1929).—The wave lengths of the

ultra-violet and green triplets of Mg I were accurately measured with the Fabry-Perot interferometer. The source was an arc between electrodes of Cu-Mg alloy operating *in vacuo*. These new values are compared with the wave lengths of the same lines in the Fraunhofer spectrum and the differences *sun-minus-arc* found to be smaller than the relativity shift for the violet lines, but larger for the green lines. In addition to the Mg lines wave lengths are given for some lines of Cu, Ca, Fe and Na. C. C. K.

Chromium echelette gratings on optical flats for infra-red investigations. R. W. WOOD. *Phil Mag* [7], 7, 742-4(1929). L. H. REVERSON

Chemical reactions in infra-red radiation (7304 A. U.). A. K. BHATTACHARYA AND N. R. DHAR. *J. Indian Chem. Soc.* 6, 451-64(1929); cf. *C. A.* 22, 2111; 23, 2887.—Many detailed exptl. data are given. A 1000-w. lamp with filters was used as the source of radiation. The rates of the following reactions have been investigated at various temps. from 20° to 40°: (1) bleaching of neocyanine, (2) bleaching of dicyanine, (3) citric and chromic acids, (4) lactic and chromic acids, (5) tartaric and chromic acids, (6) oxalic and chromic acids, (7) oxalic and chromic acids and MnCl_2 , (8) quinine sulfate and chromic acid, (9) Na lactate and I, (10) Na malonate and I, (11) Na tartrate and I, (12) Na malate and I, (13) Na citrate and I, (14) Na formate and I, (15) $\text{K}_2\text{C}_2\text{O}_4$ and I, (16) FeSO_4 and I, (17) NaNO_2 and I, (18) acetone and I, (19) MeOH and Br_2 , (20) EtOH and Br_2 , (21) Rochelle salt and Br_2 , (22) FeCl_3 and NH_4SCN , (23) K persulfate and KI, (24) decompn. of Na cobaltinitrite, (25) Na formate and HgCl_2 , (26) oxalic acid, KMnO_4 and MnCl_2 , (27) lactic acid, KMnO_4 and MnCl_2 , (28) tartaric acid, KMnO_4 and MnCl_2 , (29) citric acid, KMnO_4 and MnCl_2 and (30) $\text{K}_2\text{C}_2\text{O}_4$ and Br_2 . All of these were investigated in both the dark and in light of 7304 A. U. The temp. coeffs. for both phases of the reactions have been detd. and are found to be less in the light; thus 7304 A. U. accelerates the processes. The quantum efficiencies have been measured and usually increase with temp. Some theoretical considerations and the relationship of the work to the radiation hypothesis are discussed. W. E. V.

The Zeeman effect for the arc spectrum of gold. A. S. M. SYMONS AND J. DALEY. *Proc. Phys. Soc. (London)* 41, 431-41(1929).—Zeeman effects have been observed and measured for about 40 lines of Au I and 10 lines of Au II with a field strength of about 23,000 gauss. These new data have in large measure served to verify some of the term designations of McLennan and McLay (*C. A.* 20, 3386) and to correct others. In addn. certain new terms are suggested to account for hitherto unclassified lines. C. C. K.

Pressure shifts in the spectrum of ionized nitrogen. W. E. PRETTY. *Proc. Phys. Soc. (London)*, 41, 442-55(1929).—The change in wave length with increasing pressure of the gas in the discharge tube has been measured for about 80 N II lines between 6800 A. U. and 1850 A. U. The shifts, which in all cases are in the direction of longer wave length, appear to affect only lines arising from transitions between orbits of which at least one has a total quantum no. $n > 3$. This fact has aided in the identification of three new terms, $4p^1D_2$, $4p^1S_0$ and $4d^1D_2$. An investigation as to the cause of the shifts rules out the Doppler effect, the pressure effect analogous to that observed for arc spectra and the current density effect, as contributing factors, and attributes it mainly to a Stark effect. C. C. KIESS

The band spectrum of lanthanum monoxide. W. JEVONS. *Proc. Phys. Soc. (London)* 41, 520-45(1929).—New observations have been made of the LaO bands between 8700 A. U. in the infra-red and 2850 A. U. in the ultra-violet. The band heads have been arranged into 7 systems for each of which a formula of the type $\nu_{\text{head}} - (\nu_e + \kappa) + [u'(n' + \frac{1}{2}) - b'(n' + \frac{1}{2})^2] - [a''(n'' + \frac{1}{2}) - b''(n'' + \frac{1}{2})^2]$ has been calcd., the values for the system origins and vibrational frequency coeffs. being given in a table. Since the initial and final vibration frequencies are of so nearly the same order of magnitude the identification of a given electronic state in different systems is at present uncertain; but the present analysis confirms Mecke's conclusions (*C. A.* 23, 2103) that certain of the systems have a common final state; and corrects certain of his deductions concerning the initial and final states of other systems. To this article there is appended an excellent exposition of the present general theory of the electronic band spectra of diatomic mols. C. C. KIESS

The band systems of titanium oxide. FRANCES LOWATER. *Proc. Phys. Soc. (London)* 41, 557-68(1929).—The details of the analysis of the TiO band systems previously reported (*C. A.* 23, 3163) are now given in full. The bands in the deep red and infra-red, of which many are here reported for the first time, belong to the γ system ($^3\Sigma \rightarrow ^1\pi$ transition) which is shown to have the same final state as the previously known blue-green bands designated as the α -system ($^1\pi \rightarrow ^1\pi$ transition). The orange β -system bands represent the transition $^1\pi \rightarrow ^1\Sigma$. C. C. KIESS

New band system of titanium oxide. ANDREW CHRISTY. *Astrophys. J.* 70, 1-10

(1929).—Numerous bands in the yellow and red have been arranged in a new system whose lower level is the same as that of the blue-green system (cf. *C. A.* 23, 4138). There is evidence that *O*-branches are present in these bands, indicating that the transition is probably $a^3P - {}^3S$. The moment of inertia of the mol. in the 3S -state is estd. to be about 54.8×10^{-40} g. cm², and the corresponding nuclear sepn., is 1.66×10^{-8} cm. The heat of dissocn. for the lowest level, with linear extrapolation is 6.74 v. These two systems are both resonance systems of the TiO mol. The bands persist in stellar spectra up to 3300°K. At this temp. the product of the partial pressure of Ti and O divided by the partial pressure of TiO is 10^{-3} atm. On the assumption that with the instruments used in stellar spectroscopy the TiO bands will not be observable if the ratio of Ti to TiO is as 100 to 1, the partial pressure of O in stellar reversing layers is about 10^{-6} atm. W. F. MEGGERS

Spark spectra of sulfur. LÉON AND EUGÈNE BLOCH. *Ann Phys.* 12, 5-22(1929).—A list of wave lengths extending from 7100 Å. U. to 2200 Å. U. is presented for S II and S III. The lines were excited in an electrodeless tube by an oscillating ring discharge. Many of the lines, especially in the red, have not been measured heretofore. A few multiplets of S II representing combinations between terms already known (*C. A.* 23, 1570) and new terms are also given. C. C. KIESS

The spectrum of ionized xenon (XII). C. J. HUMPHREYS AND T. L. DEBRUIN. *Science* 68, 573(1928).—The probable combinations for the X spectrum have been detd. from the data of Albink and Dorgelo (cf. *C. A.* 22, 3584). WALLACE R. BRODE

Fine structure of infra-red absorption in organic compounds and the Raman effect. R. B. BARNES. *Nature* 124, 300-1(1929).—The infra-red absorption bands of 9 org liquids (benzene, toluene, *o*-, *m*- and *p*-xylene, ethylbenzene, butylbenzene, chlorobenzene and bromobenzene) have been studied in the 3.5μ region. This work was undertaken for the purpose of obtaining a correlation between the infra-red absorption spectra and the Raman spectra for various liquids. For each Raman line an infra red band was found which checked it very closely but many infra-red bands were found which apparently were not predicted by the Raman data. W. F. MEGGERS

Report on notation for atomic spectra. H. N. RUSSELL, A. G. SHENSTONE AND LOUIS A. TURNER. *Phys. Rev.* 33, 900-6(1929).—The report presents a scheme for the classification of spectroscopic notation in multiplet, configuration and series analyses. BERNARD LEWIS

The molecular scattering of light. J. RUD NIELSEN. *Science* 69, 15(1929); cf. *C. A.* 22, 3096.—Scattered light from gaseous butane illuminated with the H γ line 4358 Å. U. showed a wave-length shift toward the red of 0.01 Å. U. If the angle of scattering was 90°, this shift may be due to the Compton effect; however, no unmodified line is recorded. Light scattered by solid paraffin shows no wave-length shift since the scattering is not purely mol. It also seems impossible to interpret the observed effect by the Raman effect. Cf. Ross, *C. A.* 18, 3538. FLORENCE N. SCHOTT

A new connection between the absorption spectrum of hydrogen and the many-lined spectrum. O. W. RICHARDSON. *Nature* 124, 408(1929).—A no. of new band systems of H $_2$, in the green and infra-red, have been found that have as their end state the electronic level C, which is one of the initial states of the ultra-violet absorption bands of H $_2$. The initial states of these new bands, all of which have *P*, *Q* and *R* branches, are the singlet or parahelium-like levels described in recent papers (*C. A.* 23, 2883, 3163, 3405). C. C. KIESS

The potentials of halide ions from their ultra-violet absorption in aqueous solution. G. SCHEIBE. *Naturwissenschaften* 17, 86(1929); cf. *C. A.* 22, 4371.—It has been shown that the absorption spectrum of halide ions in soln. can be considered as an electron affinity spectrum differing from the one in the gas state only by the result of solvation energy influences. The energy required for the sepn. of the electron *E* here found can be related to the electrodeposition potential *P* for the halogen in question by $E + L_A - (D/2) - (L_M/2) + A = P + a$, for L_A and L_M = the heats of soln. of at. and mol. halogen, *D* the dissocn. energy of mol. halogen, *A* the electron exit work (equal for all halogens), *a* the difference between measured and abs. potential. L_A and L_M are of the same order (about 2 to 5 Cal.); their difference is negligible. It is, therefore, found that for the difference of 2 halogens $\Delta_1 = E_{Cl} - (D_{Cl}/2) - E_{Br} + (D_{Br}/2) = P_{Cl} - P_{Br} = \Delta_2$. Using for the differences in *E* the difference in frequency between the long-wave sides of the almost parallel extinction curves of the 3 elements it is shown that for Cl and Br $\Delta_1 = 0.26$ v., $\Delta_2 = 0.28$ v.; for Br and I $\Delta_1 = 0.54$ v., $\Delta_2 = 0.54$ v. The temp. dependence of the absorption by the I ion was found to agree in sign and order with that of the deposition potential. B. J. C. VAN DER HOEVEN

Ultra-violet absorption of the carbonyl group. K. L. WOLF AND W. HEROLD.

Z. physik. Chem., Abt. B, 5, 124-30(1929).—The absorption coeffs. of the 1st u.-v. absorption band ascribed to the CO group in acids, ketones and aldehydes are discussed and the literature is summarized. The values of $\log k_{\max}$ for acids and ketones in alc. solns. are contained within a narrow range, but for aldehydes in alc. solns., $\log k_{\max}$ is considerably smaller. This is ascribed to the formation of acetals, whereby the carbonyl O is converted to ethereal O; and this explanation is experimentally verified in that $\log k_{\max}$ for these solns. is found to diminish with time, the value extrapolated to zero time agreeing with that for ketones and acids. Details of the rate of acetal formation and of hydration of aldehydes can be followed by u.-v. absorption measurements. W. WEST

Absorption of ultra-violet light by some purine derivatives and allied substances. L. MARCHLEWSKI AND J. WIERZUCHOWSKA. *Bull. intern. acad. Polonoise* 1929A, 65-79 (In English).—Guanine (2-amino-6-hydroxypurine) prepd. from nucleic acid and purified by a special method causes 2 absorption bands with maxima at $\lambda 2460$ and 2744 \AA . adenine (6-aminopurine) prepd. in the same way causes 1 strong band with max. at 2606 . The spectrum of uric acid was found as reported usually with 2 bands. Allantoin, alloxan and alloxantin do not show selective absorption, whereas barbituric acid, differing but little in compn. from alloxan, shows distinctly a band with max. at 2566 . This and the fact that barbituric acid does not follow Beer's law leads to the assumption that it is a tautomeric substance. Diethylbarbituric acid, parabanic acid and urea absorb continuously. J. WIERTELAK

Anomalous dispersion by lithium vapor. A. FILIPPOV. *Naturwissenschaften* 17, 689-90(1929).—The anomalous dispersion of Li vapor was observed in the neighborhood of the first 25 members of the main series, measured for 14 of them. A H lamp was used as light source; a Jamin interferometer with platinized CaF_2 as instrument. Data are given on the intensity ratios; they do not agree with the calcs. of Hargreaves. B. J. C. VAN DER HOEVEN

Chemical valence and spectrum multiplicity. ADOLFO T. WILLIAMS. *J. chim. phys.* 25, 722-6(1929).—The relation between valence, V and multiplicity, r , is $V = r \pm 1$, which holds for all elements except the rare earths, Fe, Co and Ir. The sign depending on the relation between the total no. of electrons, the electrons in the outer sub-group, and the azimuthal quantum no. of the sub-group. WALLACE R. BRODE

The absorption spectrum of hydrogen chloride. CHARLES F. MEYER AND AARON A. LEVIN. *Phys. Rev.* 34, 44-52(1929).—The fundamental band and the harmonic band of HCl have been measured with narrow slits. The lines of the fundamental have been resolved each into 2 lines due to the isotopes Cl_{35} and Cl_{37} . The relative intensities of the lines in the 2 series are in accord with the accepted ratios for the abundance of the isotopes. In the harmonic the degree of sepn. of the lines arising from the isotopes is greater even than accomplished by Randall and Imes (cf. *C. A.* 14, 2296). Wave-no. and intensity detns. for the 2 series of lines in each band are given. Figures are presented showing the bands in the new form. The ratio of the intensities of the fundamental and harmonic bands as exptly. detd. is found to be in good agreement with the computed value. BERNARD LEWIS

The near infra-red absorption spectra of calcite and strontianite. E. K. PLYLER. *Phys. Rev.* 33, 948-51(1929).—Thick specimens were used. With a specimen 2 cm . thick cut at right angles to the optic axis, bands were observed for calcite at 1.76μ , 1.90μ , 2.00μ and 2.20μ , which have the same characteristics as those observed by Schaefer, Bermuth and Matossi (cf. *C. A.* 21, 360) in the near infra-red. The 2nd-order equations have been applied to the bands observed in this work and also to those observed by Schaefer and it was found that series relationships existed between them with only small variations of the observed from the calcd. values. In strontianite a similar set of bands was observed at 1.89μ , 2.01μ and 2.19μ , of the same type as those for calcite. The value of the inactive fundamental was calcd. as corresponding to a band at 9.2μ in good agreement with the value 9.80μ found theoretically by Nielson (cf. *C. A.* 23, 2102). BERNARD LEWIS

The effect of temperature on the absorption bands of fused quartz in the infra-red. W. A. PARLIN. *Phys. Rev.* 34, 81-91(1929).—The absorption bands of specimens of fused quartz ranging in thickness from 2 mm . for the 3μ region to $4 \times 10^{-4} \text{ mm}$. for the 8μ region were studied. In regions where sufficient energy was available an echelette grating was used to give greater dispersion. Measurements were taken at room temp. and at 850° . In accord with previous work, the absorption band in the region of anomalous dispersion at 9μ was found to shift toward longer wave lengths with increasing temp. With higher resolution, however, fine-structure bands were found which did not shift with temp., but did undergo marked changes in intensity. Several

sharp bands between 2μ and 4μ were found to remain fixed as the temp. was changed. A broad double band was found at 12.5μ . These bands did not shift with temp. It was found that inside the strong bands the absorption was much less at high temps. while outside the bands the reverse was the case.

BERNARD LEWIS

Analysis of the HCl bands. W. F. COLBY. *Phys. Rev.* **34**, 53-6(1929).—Wave nos. for the 2 isotopes of HCl in the bands at 3.5μ and 1.76μ have been fitted to formulas, cubic in the rotational quantum no. From these formulas the consts. of the mol. have been detd. in accordance with the energy expressed for the rotating dipole as derived by means of wave mechanics.

BERNARD LEWIS

Combination bands in the infra-red spectra of carbon tetrachloride and silicon tetrachloride. H. H. MARVIN. *Phys. Rev.* **33**, 952-3(1929).—It is assumed that the 6 Raman bands of CCl_4 found by Pringsheim and Rosen (*C. A.* **23**, 39) give the fundamental absorption frequencies. Simple combination of these frequencies by addn. account for all the absorption bands between 1μ and 16μ except in very weak bands. The absorption bands of SiCl_4 in the same region are accounted for by similar combinations of 6 fundamental frequencies, 4 of which are known either as Raman bands or as resonance frequencies in the dispersion formula. The two systems of fundamental frequencies are similar, as one might expect from the chem. similarity of the 2 compds.

BERNARD LEWIS

Some peculiar hydrogen bands. CHARLES J. BRASEFIELD. *Phys. Rev.* **33**, 925-31 (1929).—Photographs of the *secondary spectrum* of H_2 as excited by an electrodeless discharge were taken at various pressures between 0.08 and 0.001 mm. A no. of lines were found to be much more intense at low pressures than at high pressures. The more predominant of these were arranged into a band with P, Q and R branches, corresponding to a $\Pi \rightarrow \Sigma$ type electronic transition. This band was assumed to be a $0 \rightarrow 0$ band. The majority of the remaining lines were tentatively arranged into 3 more bands which appeared to be the $1 \rightarrow 0$, $0 \rightarrow 1$ and $1 \rightarrow 1$ bands corresponding to the same $\Pi \rightarrow \Sigma$ transition. The value of the moments of inertia are $I_1' = 3.8 \times 10^{-40}$, $I_1'' = 5.5 \times 10^{-40}$, $I_0'' = 2.0 \times 10^{-40}$ and $I_1'' = 2.3 \times 10^{-40}$. The corresponding nuclear seps. are $r_0' = 2.14 \times 10^{-8}$, $r_1' = 2.57 \times 10^{-8}$, $r_0'' = 1.55 \times 10^{-8}$ and $r_1'' = 1.66 \times 10^{-8}$ cm. The emitter of these bands is thought to be either H_2^+ or doubly excited H_2 .

BERNARD LEWIS

Band spectrum of magnesium oxide. P. N. GHOSH, B. C. MOOKERJEE AND P. C. MAHANTI. *Nature* **124**, 303(1929).—The band spectrum of MgO has been studied with a Hilger quartz spectrograph and 8 distinct groups of bands extending from 4372 to 5700 Å. U. have been found. The 61 band heads have been arranged in the usual n' , n'' progression, and the $\Delta\nu'$ and $\Delta\nu''$ values of the bands can be well represented by a 3rd-degree equation.

W. F. MEGGERS

The second spark spectra of sulfur, S III. S. B. INGRAM. *Phys. Rev.* **33**, 907-13 (1929); cf. *C. A.* **23**, 36.—With exptl. data previously obtained the spectrum of S III is analyzed. Most of the triplets predicted by the Hund theory are found and the strongest lines in both the visible and extreme ultra-violet are classified. The ground term $3s^23p^2^4P_0$ gives the ionization potential as 34.9 ± 0.4 v. Complete term tables and a list of classified lines are given. The term $3s^23p4s^1P$ is anomalous, having a total sepn. of 450 while the p doublet of the ion is 950. The interval ratio is 10 to 1, instead of 2 to 1 given by Landé's rule. Combinations of this term with the ground term in the ultra-violet are unusually weak.

BERNARD LEWIS

Spectrum of trebly ionized argon. D. S. JOG. *Nature* **124**, 303(1929).—The lines of trebly ionized A have been classified with the aid of the extension of the irregular-doublet law and the method of horizontal comparison. All the quartet multiplets due to the transition $2M_2(N_2 \leftarrow N_1)$ have been obtained.

W. F. MEGGERS

Polarization of material waves. A. LANDÉ. *Naturwissenschaften* **17**, 634-7 (1929).—The main difference between polarization of optical waves and that of material waves is that optical linear waves are independent if at 90° , material waves of at 180° . For the latter, polarization is a matter of sepg. two anti-parallel directions. A Nicol type polarizer for material waves is the Stern-Gerlach instrument with non-homogeneous magnetic field, one direction being extinguished by a diaphragm. The intensity of the light transmitted by a second "analyzer" instrument will be $J_{\text{anal.}} = J_{\text{pol.}} \cos^2(\varphi/2)$. A transverse magnetic field between polarizer and analyzer causes elliptic polarization, a longitudinal magnetic field rotation of the plane of polarization. Double refraction of material waves has been exptly. demonstrated (Rabi, *C. A.* **23**, 3624).

B. J. C. VAN DER HOEVEN

Some aspects of ultra-violet microscopy. J. E. BARNARD. *J. Roy. Micros. Soc.*

287, 91-101(1929).—A general discussion of problems encountered in developing new app. for ultra-violet microscopy: materials for lenses, sources of monochromatic light, reflecting power of alloys. A special dark-field illuminator, which utilizes magnesium reflecting surfaces, is described.

C. W. MASON

The parameters which characterize the partial polarization of light in the phenomena of fluorescence. PAUL SOLEILLET. *Ann. phys.* 12, 23-97(1929).—See C. A. 23, 2659.

C. C. KRESS

Ionization of air by a glowing wire. P. HANCK. *Z. physik. chem. Unterrichts* 41, 189(1928).—To prove that wires at red-heat emit positive and at white-heat negative ions, the wire, first red-hot, is brought near a negatively charged electroscope. The positive ions discharge the electroscope. The heat is increased till the wire is white-hot. Brought near a positively charged electroscope, the negative ions discharge the electroscope. The expt. is repeated with the electroscopes reversed.

M. BEBER

Simultaneous ionization and dissociation of oxygen and intensities of the O_2^+ bands. E. C. G. STRECKELBERG. *Phys. Rev.* 34, 65-7(1929).—Observations by Hogness and Lunn (C. A. 20, 2046) and Smyth and Steckelberg (C. A. 23, 2098) showing that O^+ is formed from the neutral mol. by a single impact of about 20 v. are explained from the potential-energy curves of the mol. and ion. These have been obtained from a method given by Morse (cf. C. A. 23, 5406). The intensities of the ultra-violet O_2^+ bands have been calcd. from the same curves and are in good agreement with expt.

B. L.

Ionization by electron impact. KICHIRO OCHIAI. *Proc. Phys. Math. Soc. Japan*, 3rd Ser., 11, 42-72(1929), cf. C. A. 23, 3848.—The collision between an electron and a H atom is considered in wave mechanics. The probability of ionization is a max. when the colliding electron has an energy about twice the ionization potential (or somewhat smaller).

W. WEST

Simultaneous ionization and excitation of diatomic molecules by impacts with positive ions and excited atoms. O. S. DUFFENDACK and H. L. SMITH. *Phys. Rev.* 34, 68-90(1929). A study of mixts. of He, Ne and Ar with CO and N_2 is made wherein it is demonstrated that impacts occur between a rare gas ion and a diatomic mol. leading to ionization and excitation of the latter. It is also shown that impacts of the second kind between excited He and Ne atoms and neutral CO mols., resulting in the simultaneous ionization and excitation of the latter, are possible. Expts. are described which show the effectiveness of either type of impact to be the greatest when the energy difference is the least. These impacts explain several previously observed but unexplained effects in similar mixts. in glow discharges. Two new bands in the Balke-Johnson band system are due to ionized CO with edges at $\lambda\lambda$ 4454.95, 4458.94, 4480.24, 4485.00; and 4494.30, 4498.31, 4519.89, 4524.89, are reported and six new edges and a new band at $\lambda\lambda$ 3413.14, 3414.60, 3584.20, 3600.75; 4116.69, 4348.08; 5856.30, 5860.37, 5905.85 in the comet-tail system. The wave lengths of the heads of all the bands of these two systems observed in the investigation have been measured and an analysis of the systems is given. From a study of the intensity distribution of the negative band systems of CO excited in He-CO and Ne-CO mixts., the following deductions relative to the degree of excitation of the CO ion in the two mixts. are made. In Ne-CO mixts. there are many more CO ions in the 16.8-v. state than in the 20 v. state, but in the He-CO mixts. the reverse is true. A study of the intensities of the individual comet-tail bands excited in He-CO and in Ne-CO mixtures under the same conditions shows that the exciting processes in He-CO mixtures are more effective in exciting the higher vibrational states of the comet-tail bands than they are in Ne-CO mixts. The spectrum of CO_2 recently observed and reported by Fox, Duffendack and Barker (C. A. 21, 2433) is due to the CO_2 ion.

BERNARD LEWIS

The spectra of alkali metals excited by active nitrogen. J. OKUBO and H. HAMADA. *Phil. Mag.* [7], 7, 729-36(1929).—The authors report further observation (cf. C. A. 22, 1730) of the dependence of the spectral line on the d. of Na vapor. A dense Na vapor in contact with active N also gives the band spectrum due to Na mols. A further increase in vapor density excites a band spectrum due probably to sodium nitride. Similar phenomena are observed with both K and Cs. In Na there appears a green central core of light surrounded by a yellow aureole. In the green core the first subordinate series is more enhanced than the principal series, while in the aureole this effect is reversed and the principal series is predominant. In K the lines of the principal series are intense in the pale green outer aureole, while in the pink core the subordinate series is more enhanced. The same effect was observed in the purple aureole in Cs vapor, and in the yellowish purple core. These results may be accounted for on the basis of collisions of the second kind between excited and neutral atoms as well as the

fact that transitions allowed by the selection principle of azimuthal quantum nos. are highly favored in the excitation process by electronic collision. L. H. REYERSON

Reactions of ethylene, hydrogen and the saturated hydrocarbons under the influence of excited mercury. HUGH S. TAYLOR AND DOUGLAS G. HILL. *J. Am. Chem. Soc.* **51**, 2922-36(1929); cf. *C. A.* **21**, 3831.—The photosensitized combination between H_2 and ethylene gives as primary reaction satd. hydrocarbons. The compn. of the products depends upon the concn. of H_2 and is independent of pressure and temp. The satd. hydrocarbons are subsequently decompd. both by excited Hg atoms and at. H. Methane is the stable product in the gas phase and a liquid polymer C_2H_4 is deposited on the walls. A mechanism to explain these results is proposed. E. SCHOTTE

Phosphorescent compounds of temporary action. L. VERNITZ. *Trans. State Inst. Applied Chem.* (Moscow), No. **8**, 46-59(1927).—Phosphorescent substance of temporary action are CaS, BaS, SrS; they are light accumulators and are luminescent in the dark only for some time after their exposure to light, and they differ from crystalline ZnS by the fact that radioactive substances do not stimulate them to luminescence. These luminescent substances are solid solns. and consist of 3 essential ingredients: sulfide of the earth-alkali metal (resonator), particles of heavy metals (excitators) and colorless salts (flux) assisting the soln. of the excitator in the resonator. V. investigated the conditions of obtaining luminophores with max. luminescence and duration of light, as well as the reasons why seemingly similar conditions often give products of unequal quality. CaS must be prepared from CaO; BaS and SrS from the corresponding carbonates; and these 3 materials must be absolutely free from traces of other metals, since the latter act as excitators, and since only a definite quantity of excitator produces the max. effect. 30 parts of repeatedly recrystallized S is mixed with 100 parts of either CaO, BaCO₃ or SrCO₃, the necessary quantity of aq. (or alcoholic, in case of Bi(NO₃)₃) soln. of the salt of the active metal, also a definite quantity of Th(NO₃)₃ soln. (to make phosphorescence more lasting), the mixture is evaporated to dryness, stirred, heated in a closed porcelain crucible over a Bunsen burner 10-30 min., after which the mass is cooled, pulverized, mixed with a definite quantity of flux, calcined a definite time at a definite temp., measured by a pyrometer, then quickly cooled, etc. These operations were effected under various conditions to establish the influence of each factor, and the results, which depend very much on the exact observance of minute details described by V., are recorded. BERNARD NELSON

Time-lags in fluorescence and in the Kerr and Faraday effects. E. GAVIOLA. *Phys. Rev.* **33**, 1023-34(1929).—A crit. study of the exptl. literature is made in regard to the existence of time lags or dark times in fluorescence. G. finds that not a single expt. shows their existence. Moreover, expts. seem to show that in all the cases when the emitting state is the state reached directly as a result of the excitation process, the emission begins immediately upon excitation and decreases exponentially. Expts. interpreted as showing the existence of time-lags in the Kerr and Faraday effects are also considered and it is found that they do not prove the reality of such time-lags. It is shown that the behavior of Beams' optical shutter is different than supposed. Wave trains cut off by it are in reality about 100 times longer than was assumed.

BERNARD LEWIS

Phenomenon of diffusion-Raman effect. A. CARRELLI. *Atti accad. Lincei* [6], **9**, 165-9(1929).—Observations of the Raman effect on $C_2H_2Cl_2$ and CCl_4 agree with the theories, mathematical proof of which is given. Raman radiation is polarized differently for the various wave lengths; polarization with Raman light may be greater than with the Tyndall light. The intensity of Raman light is proportional to the fourth power of the frequency, as in the Tyndall light, but in addition is a function of the frequency of the lines emitted. A. W. CONTIERI

The Raman effect in gases. I. Hydrochloric acid and ammonia. R. W. WOOD. *Phil. Mag.* [7], **7**, 744-9(1929); cf. *C. A.* **23**, 2365.—An app. is fully described which was found suitable for obtaining the Raman effect in gases. Measurements were made on NH_3 and HCl. With HCl a surprising result was obtained: for each exciting line a single line only, of modified wave length, was radiated, and the frequency difference between the exciting and emitted radiation was the frequency of the "missing line" of the infra-red absorption band at 3.4645μ . NH_3 at atm. pressure gave a single line also. A sharp triplet was also excited by Hg 3650, 3654 and 3663, of which the outer lines had wave lengths of 4157 and 4172. The frequency differences in NH_3 are identified with the infra-red absorption band at 3μ . L. H. REYERSON

The Raman effect of helium excitation. R. W. WOOD. *Phil. Mag.* [7], **7**, 858-66(1929).—W. describes an improved method for cooling the Hg arc used for the excitation of Raman lines so that the cooling is effected by a very small quantity of absorbing

medium. The results show that the Hg arc method of excitation is unsatisfactory in that it is incapable of providing truly monochromatic excitation radiation. A He discharge tube is then described which, when used in conjunction with a filter of NiO glass, transmits the 3888 Å. U. line to almost full intensity and the lines 3965 and 4025 Å. U. with such feeble intensity as to give no Raman lines. This app. has been satisfactorily used with liquids of b. p. 40°. A method is given for prep. a standard scale from which the wave lengths of the infra-red absorption bands, corresponding to the Raman lines, can be read directly.

L. H. REYERSON

Raman spectrum and fluorescence of benzene. C. V. SHAPIRO. *Nature* 124, 372 (1929).—Recent work on the Raman effect has indicated that the frequencies so detd. may be attributed to vibrational frequencies or combinations of such frequencies, of the normal electronic state of the mol. It is therefore to be expected that these levels will appear as end states in the process of emission or fluorescence. This is confirmed in the case of C_6H_6 vapor, for which data on fluorescence are available from the work of Reimann (*C. A.* 20, 2953).

W. F. MEGGERS

Decomposition of ethylene by ultra-violet light. R. B. MOONEY AND E. B. LUDLAM. *Trans. Faraday Soc.* 25, 442-5 (1929).—It has been shown that C_2H_4 is decompd. by light of wave length shorter than $210m\mu$, giving C_2H_2 as one decompn. product. The presence of Hg vapor is not essential. The ultra-violet absorption spectrum has been studied. The long wave-length limit of absorption ($210-13m\mu$) coincides with that calcd. from the heat of disson of C_2H_4 to C_2H_2 and at. H.

LOUIS WALDBAUER

Decomposition of carbon monoxide in the silent electrical discharge. ROBERT W. LUNT AND LEONARD S. MUMFORD. *J. Chem. Soc.* 1929, 1711-23.—An investigation of the brown solid found previously (cf. *C. A.* 21, 2436). The loss of O_2 leading to dispute between Berthelot and Schutzenberger (cf. *Compt. rend.* 110, 560, 681 (1890)) is explained by the formation of C_3O_2 . Decomposition takes place in spite of elaborate drying of app. and gases. The brown solid formed is not identical with polymerized C_3O_2 .

GREGG M. EVANS

Photochemical studies. IX. Uranyl sulfate as sensitizer for the photochemical decomposition of oxalic and malonic acids. WILLIS C. PIERCE. *J. Am. Chem. Soc.* 51, 2731-8 (1929), cf. *C. A.* 23, 1353.—The sensitized photochem. decompn. of malonic acid by uranyl sulfate has a temp. coeff. of 1.13 ± 0.02 . The analogous decompn. of oxalic acid has a temp. coeff. of unity. The rate of the process varies with the concn. of UO_2SO_4 and with the concn. of malonic acid and approaches a const. value. The variation is most pronounced when the molar ratio of malonic acid to UO_2SO_4 is less than unity; for concns. when this ratio is greater than one the variation in the rate is small. It is commented that the oxalic and malonic acid decompns. are of similar mechanisms despite the differences in temp. coeffs. and quantum efficiencies. Two mechanisms have been postulated: (1) complex ion decompn.; (2) collisions of the second kind between UO_2 ions in an activated state and acid mols.

W. E. V.

The extinction coefficient of tribromide ions and its function in photochemical reactions. RUKMINI MOHAN PURKAYASTHA. *J. Indian Chem. Soc.* 6, 361-73 (1929).—The reaction between mandelic acid and Br in the presence of KBr has been investigated in both white and blue light at temps. of about 32°. The course of the process was followed by titration with thiosulfate. The temp. coeff. was 1.7-1.8. The dark reaction is very slow; the light process is zero mol. in the presence of excess KBr and excess of the acid. The const. increases with the ratio of free Br_2 to Br_3^- . The blue light is the effective wave length for the reaction, which has velocity const. proportional to the square root of the intensity of the incident radiation. The extinction coeffs. of Br_3^- for 536 $m\mu$, 546 $m\mu$ and 579 $m\mu$ have been detd. P. believes that blue light absorbed by Br_3 ions is simply dissipated and does not contribute to the photochem. reaction, and that Br_2 upon absorption gives Br, which is the active constituent. It is thought that oxidation processes by I_2 in the presence of KI follow the same course.

WILLIAM R. VAUGHAN

The abnormally high production of the thorium mineral, orangite. H. HERSZ FINKEL. *Naturwissenschaften* 17, 673 (1929).—By using the Swietoslowski-Dorabralaska app. (*C. A.* 22, 514) the heat production of orangite was again detd. (cf. Poole, *C. A.* 6, 830). Orangite from Arendal (Norway) gave 34 times, from Langesund 30 times the heat expected from their Th contents. Some black glassy parts of the latter gave even as high as 150 times the expected heat. The amts. of mineral used were from 6 to 10 g. Thorite also gave a heat anomaly; the U minerals and Th oxide did not. The heat from a mixt. of pulverized orangite and about 0.03 to 0.1 mg. Ra was no more than the sum of the 2 heats.

B. J. C. VAN DER HOVEN

Layers of cesium and nitrogen on tungsten. N. A. DE BRUYNE. *Proc. Cambridge*

Phil. Soc. 25, 347-54(1929).—The thermionic emission from a W filament in Cs vapor may give 2 max. in the plot of emission vs. heating current (or temp.). The first max. is due to emission by Cs on the W and the second to N present. The second max. disappears when only Cs and no N is present. The emission current for the first hump does not vary greatly with anode voltage (practically the same for 1.3, 10 and 40 v.) but the current intensity at the second max. increases with voltage. It does not appear until 9 v. Thus the secondary max. seems to be due to an excited form of N.

WILLIAM E. VAUGHAN

X-ray inspection of castings (St. John) 9. Organic dipole molecules with singly and doubly bound O (Wolf) 2.

4—ELECTROCHEMISTRY

COLIN G. FINK

High-frequency furnaces. ANON. *Elec. World* 94, 557-8(1929).—Tests, results and operating records of installations of Ajax-Northrup coreless induction furnaces at the Beaver Falls plant of the Babcock & Wilcox Tube Co. are given. Great uniformity of analysis and high quality feature the products.

W. H. B.

The Bornand electric furnace. MARCEL GUÉDRAS. *Aciers speciaux* 4, 274-7(1929).—The Bornand furnace is equipped with a plunger of refractory material that surrounds the electrodes. By lowering and raising this in the fused bath an agitation is produced which accelerates the reaction. The application of the furnace in steel manuf. and refining is described in some detail.

A. J. MONACK

Selection of electrical equipment for arc furnaces used in the melting and refining of ferrous metals. SAMUEL ARNOLD, 3RD. *Iron and Steel Eng* 6, 75-8(1929).—Selection of proper elec. equipment requires attention to: (1) correct transformer capacity for the size of furnace used and the work handled; (2) proper voltage range and control together with the correct amt. of reactance for each voltage applied; (3) proper design of bus and cable structure; (4) proper application of regulating and metering equipment; (5) proper switching equipment. Where a pure water supply is available, 3-phase water-cooled transformers are utilized, with the attendant saving of space and cheaper cost. From 3 to 4 voltages are made available by multiple Δ- and Y-connections on the primary side of connections of the power transformer, utilizing electrically operated oil circuit breakers for switching. Advantages and disadvantages of air core and iron core reactors are pointed out. Certain precautions are noted for furnace operation.

W. H. BOYNTON

Production of ammonium sulfate electrically. WESTPHAL. *Gas. u. Wasserfach* 72, 911-2(1929).—The Thuringian Gas Co. of Leipzig, Germany, has devised a new method (patents applied for) for prep. $(\text{NH}_4)_2\text{SO}_4$. Dry NH_3 gas from ammonia liquor is used as the source of NH_3 . SO_2 is prepd. by burning spent Fe oxide sponge and leading the gas through an elec. furnace to form SO_3 . The SO_3 and NH_3 gases are then mixed in the proper proportions, and with enough moisture to form $(\text{NH}_4)_2\text{SO}_4$, which is sep'd. in an elec. precipitator. The resultant product is pure white and in a good form for agricultural use.

R. W. RYAN

The thermal and electrothermal reduction of zinc oxide and remarks about the use of iron resistors up to 1200°. O. DONY-HÉNAULT. *Am. Electrochem. Soc. Pamphlet*, May, 1929, 4 pp.—Fe resistors have been tried out and found to be satisfactory up to temps. 1200°. With these resistors as heating elements, fractional distn. of oils could be carried out for the direct production of toluene free from any trace of thiophene. Likewise, an Fe resistor was used for an investigation on the reduction of Zn oxide at temps. 1150° and above. CO was used as reducing agent. Expts. at 1000° and 11 atm indicate that in metallic retorts the reduction can be carried out quantitatively, whereas such is not possible when porous refractory retorts are used.

C. G. F.

Economic melting of soft metals by electric heat. J. S. KEENAN. *Elec. News and Eng.* 38, 46(1929).

C. G. F.

Electrolysis with diaphragms (potassium carbonate). O. A. ESIN. *Z. Elektrochem.* 35, 492-500(1929).—For the electrolysis of solns. of salts through porous diaphragms a relation is derived between the concn. of the salts and that of the resulting alkali. To produce a given concn. of alkali the amt. of elec. current required may be calcd. The calcd. values agree with those of other investigators as well as with data derived from new expts. on the electrolysis of K_2CO_3 solns.

H. F. JOHNSTONE

Studies in the measurement of electromotive force in dilute aqueous solutions. I. Study of the lead electrode. WALTER R. CARMODY. *J. Am. Chem. Soc.* **51**, 2905-9(1929).—A new method of e. m. f. measurement in dil. solns. by frequent renewal of soln. is described. The normal electrode potential of Pb and activity coeffs. of PbCl_2 were detd. from the cell $\text{Pb}(\text{Hg}), \text{PbCl}_2, \text{AgCl}, \text{Ag}$. [The temp. is not stated although it is apparently 25°] MALCOLM DOLE

(Photoelectric) study of the silver chloride electrode. WALTER R. CARMODY. *J. Am. Chem. Soc.* **51**, 2901-4(1929).—AgCl deposited electrolytically on CN^- -free Ag plate in the dark is pure white and its potential is affected by the light in contrast to previous types of AgCl electrodes. MALCOLM DOLE

Cadmium plating. A. R. PAGE. *Metal Ind.* (London) **35**, 173-5(1929).—A review. P. recommends the double cyanide bath plus dextrose. Cd deposits on steel 0.0002 in. thick will protect the steel from corrosion for over a week when exposed to the salt spray. Ni can be satisfactorily deposited over Cd. After the Cd has been deposited the articles should be given a cold swill, then a strong acid dip followed by another swill. Immersion into the Ni bath should then immediately follow. C. G. F.

Chromium plating. CESARE A. GUIDINI. *Schweiz. Apoth.-Ztg.* **67**, 87-90; *J. pharm. Alsace Lorraine* **56**, 78-81(1929).—A brief account of the electrodeposition of Cr, and the advantages of Cr-plated utensils in pharmacy. S. WALDBOTT

Failures in nickel plating—their causes and their cures. WM. VOSS AND RALPH J. SNELLING. *Metallborse* **19**, 1967-8, 2023-4(1929).—From practical experience extending over many years the authors group the causes of failure under 17 headings, giving symptoms and cures accordingly. W. C. EBAUGH

Electrolytic coating of wire with zinc. KARL SCHUCH. *Chem.-Ztg.* **53**, 397-8(1929).—A description of the technical application of electroplating Zn upon wire. The bath consists of 100 l. H_2O , 32 kg ZnSO_4 , 9 kg. $(\text{NH}_4)_2\text{SO}_4$, 5 kg Na_2SO_4 , 3.5 kg. H_3BO_3 . H. STROETZ

Use of non-ferrous metals in the electroplating industry. FLOYD T. TAYLOR. *Mining Met.* **10**, 475-8(1929).—An address. C. G. F.

Refinery production of nickel salts used for electroplating. S. SKOWRONSKI. *Eng. Mining J.* **128**, 514(1929).—To keep the As and Ni contents of the electrolyte within the prescribed limits, some of the electrolyte is withdrawn daily from the circulation and purified. Refining methods vary, but usually Cu is removed by electrolysis with insol. anodes or by crystn. from the strong acid soln. of 85-90% of the Cu as a commercial grade of bluestone, the Cu in the mother liquor being removed by electrolysis. The Cu-free soln. is evapd. in iron pans to fumes of SO_3 , whereby Fe and Ni sulfates are salted out. The supernatant liquor contg. H_2SO_4 and As may be sold or distd. to yield 60° Bé. acid and an As salt cake. The anhyd. salts are dissolved in water, the Fe is oxidized by bleaching powder or lime and pptd. with lime (also removing the traces of Cu and Zn). The resulting Ni sulfate soln., after filtration, may be crystd. as high-grade Ni salts. W. H. BOYNTON

The ballistic effect shown by polished metal strips. J. LOISELEUR. *Compt. rend.* **189**, 245-6(1929).—When a newly polished strip of metal is placed between 2 similar platinized Pt electrodes immersed in a conducting soln., there is a noticeable e. m. f. between the 2 electrodes, sufficient to deflect a galvanometer needle. As the metal is brought nearer to one of the electrodes, the e. m. f. is increased; when contact is made the contact potential of the metal is measured. E. G. VANDEN BOSCHE

The poisoning of the hydrogen electrode. A. H. W. ATEN AND (MISS) M. ZIEREN. *Rec. trav. chim.* **48**, 944-8(1929).—The authors assume that the electrochemically active H of the electrode is at. The at. H is a product of the H mols. on the surface of the electrode. The reaction $\text{H}_2 \rightarrow 2\text{H}$ is retarded through the action of the poison, but the reaction $2\text{H} + \text{O} = \text{H}_2\text{O}$ is not (or much less) affected by the poison. Accordingly, in the presence of O and a poison the concn. of H atoms will drop and the electrode potential rise. The best grades of H_2SO_4 and NaOH obtainable on the market contained a poison. Its effect is readily shown in smooth, bright Pt electrodes, but not readily in platinized electrodes. The poison may be removed by keeping a Pt electrode in the electrolyte for a long time; it seems to ppt. on the Pt. The thus purified soln. gives the correct potential values with a fresh electrode. Small quantities (0.07 to 0.7 g./l.) of As_2O_3 added to 0.1 N H_2SO_4 soln. had a very marked effect on the electrode potentials. The addn. of As_2O_3 and HgCl_2 accelerates the diffusion of H. Fe sheets (0.1 mm. thick) polarized cathodically in 0.1 N NaOH gave no evidence of diffusion of H. However, upon the addn. of a trace of HgCl_2 , diffusion took place immediately. Conclusion: The poison retards the reaction $2\text{H} \rightarrow \text{H}_2$. The investigation is being extended. C. G. F.

Electrochemical reproduction of macrostructure. A. GLAZUNOV. *Chimie & Industrie Special No.*, 425(Feb., 1929).—By placing a plate or sheet of metal in contact with thick waterleaf paper impregnated with a soln. of a suitable salt and placing the paper on another sheet of metal, if the 2 metals are connected to a source of current the structure of the metal acting as anode will be reproduced on the paper. $K_4Fe(CN)_6$ can be used for Fe or Cu, and $K_2Cr_2O_7$ for Ag. A. PAPINEAU-COUTURE

A new type of electric pile. O. SCARPA. *Giorn. chim. ind. applicata* 11, 307-9 (1929).—The following systems generate currents similar to the Volta pile: Cu-Hg-Zn-Cu, Cu-Hg-Cd-Cu, also the concn. piles Cu-Zn amalgam (C_1)-Zn amalgam (C_2)-Cu, and Pt-Zn amalgam (C_1)-Zn amalgam (C_2)-Pt. The above systems give currents when at const. temps. so that Volta's law on elec. piles must be limited in that metals in contact at const. temp. do not give any current providing they do not react with each other. A. W. CONTIERI

Galvanic electricity and cohesion pressure. Space energetics. RICHARD V. DALLWITZ-WEIGER. *Z. Elektrochem.* 35, 344-9(1929).—It is shown that the capacity of galvanic cells can be detd. from the cohesion pressures of the different constituents. H. STOERTZ

Electroösmosis and electrophoresis in their technical applications. I and II. F. CHEMNITZ. *Chem. Ztg.* 53, 361-2, 378-80(1929).—A discussion. H. STOERTZ

The effect of high-frequency discharges on the dissociation of gases. MELVILLE J. MARSHALL AND EDWARD H. NUNN. *Trans. Am. Electrochem. Soc.* 55, 119-29(1929).—The degree of dissocn. of various gases in the high-frequency discharge has been measured by noting the almost instantaneous pressure increase when the discharge is passed. The dissocn. of diatomic gases in the high-frequency discharge depends on the dimensions of the discharge chamber. An ordinary ozonizer tube, with the electrodes outside the glass, gave a very small dissocn., while cylindrical tubes with similar external electrodes at the ends gave values of over 50% for the higher pressures. The dissocn. decreases with decrease in pressure. Air gave a higher dissocn. for the same applied voltage and gas pressure than H_2 . Cl_2 was also shown to give at least a normal dissocn. C. G. F.

The mathematical theory of the Cottrell electric precipitator. A. W. SIMON. *Iron and Steel Eng.* 6, 143-6(1929).—A simple derivation is shown of the formula for the cleaning efficiency of a Cottrell pass. The effect of length of pass and the effect of velocity of gas through the precipitator on cleaning efficiency are shown in curves; applications of the equation are indicated. W. H. BOYNTON

Blast-furnace gas cleaning. C. W. HEDBERG. *Iron and Steel Eng.* 6, 426-40 (1929).—The present trend is toward cleaner gas for stoves and boilers and new uses are contemplated which are predicted largely on the gas being available, with barely a trace of suspended matter. These are possible only to the extent that improvements and operating economies can be effected in cleaning systems and equipment. This paper deals with the efficiency of the Cottrell elec. pptn. Elec. pptn. for primary or "dry" cleaning and for secondary cleaning is discussed. One of the principal applications of Cottrell elec. pptn. appears to be for secondary cleaning after existing scrubber equipment, and another use is in combination of all or portion of the gas in pptn. equipment using in the primary step the spray cooling method of conditioning and min. equipment necessary to permit uninterrupted operation of the hurdle cooler. The installations at several plants are briefly described, and an extensive discussion of the paper is appended. W. H. BOYNTON

The use of triodes (vacuum tubes) in electrochemical measurements. A. H. W. ATEN, L. M. BOERLAGE AND D. CANNegiETER. *Chem. Weekblad* 26, 426-30(1929).—Various methods are discussed for the use of triodes in electrochem. work: amplifiers for a c. Wheatstone bridge, generators for pure a. c., rectifiers for a. c., potential measurements of cells with great internal resistance, etc. Examples are given. B. J. C. v. d. H.

Properties and tests of carbon brushes for motors and generators. G. M. LITTLE. *Power Plant Eng.* 33, 830-41(1929); cf. *C. A.* 23, 3633. —In addition to certain physical requirements, chemical properties are also important. Scouring or abrasive material must be absent. Several tests are suggested to assure satisfactory compn. D. K. F.

New type of low-frequency low-voltage discharge in a neon lamp. G. R. PARANJPUR AND K. SHRESHADRIENGAR. *Nature* 122, 959-60(1928). H. L. D.

Chemistry in incandescent lamp manufacture. W. J. BARTLETT. *Ind. Eng. Chem.* 21, 970-3(1929).—A review. C. G. F.

Combination electrochemical switchboard. W. FAITOUTE MUNN. *Ind. Eng. Chem., Anal. Ed.* 1, 208(1929).—A compact electrochem. switchboard is described. Power is supplied by a no. of dry cells or storage batteries. C. G. F.

Influence of the curvature of solids on the chemical and electrolytic phenomena in which they take part (LUCK) 2. Electrodeposition of Bi from an acid solution (JILK, LUKAS) 7. Anodic behavior of Al (GÜNTHERSCHULZE) 2. Electrical heating system for oil stills (U. S. pat. 1,730,112) 22. Freeing Cu from Cu oxide (U. S. pat. 1,730,775) 9.

Electrodeposition of iron. FRED K. BEZZENBERGER (to Aluminum Co. of America). U. S. 1,729,607, Oct. 1. An electrolyte suitable for deposition of Fe on Al or its alloys comprises a soln. of FeSO_4 contg. pptd. Fe hydroxide in suspension and having a mud-like consistency.

Electrodeposition of chromium. RUDOLF AUERBACH (to Chromeplate, Inc.). U. S. 1,730,349 Oct. 8. In order to decrease the H-ion concn., Na oxalate, Cr acetate or other suitable salt of an acid with a dissoen. const. less than that of H_3PO_4 is used with a soln. of chromic acid contg. a free, highly dissoed. acid such as H_2SO_4 . Cf. C. A. 23, 2109

Chromium-plated exhaust valves for internal-combustion engines. WM. M. PHILLIPS (to General Motor Corp.). U. S. 1,731,202 Oct. 8. Both the bearing portion and the exposed portion of the stem are plated with Cr, as is also the head.

Polarizing electrolyte. PHILIP E. EDELMAN (to Ephraim Banning). U. S. 1,730,725, Oct. 8. A sirup of a sol. org. gum such as gum arabic is used for making up electrolytes for rectifiers, etc.

Coils for electrodynamic devices such as acoustic devices. ALBERT L. THURAS (to Bell Telephone Laboratories Inc.). U. S. 1,729,806, Oct. 1. Movable coils are formed of metal such as Be in which the product of mass and resistance is about one-third that of Al.

Electric resistance furnace. JACOB WEINTZ (to Strong, Carlisle and Hammond Co.). U. S. 1,730,103, Oct. 1. Structural features.

Electric resistance furnace suitable for heat treating small articles, etc. CARL L. IPSEN (to General Electric Co.). U. S. 1,731,166, Oct. 8. Structural features.

5- PHOTOGRAPHY

C. E. K. MEES

Studies in photographic sensitivity. III. Sensitizing action of previous exposure to a dim light. O. MASAKI. *Mem. Coll. Sci., Kyoto Imp. Univ.* A12, 107-16(1929); cf. C. A. 23, 4900.—A systematic study of the pre fogging of photographic plates by a uniform light exposure was made. Certain plates thus treated have greater density than that corresponding to the sum of the 2 exposures. Fogging made before the main exposure is more effective than that made afterward. The sensitizing action produced by preexposure gradually decreases with increase of time between the 2 exposures. The sensitizing action produced by red light is greatest; that produced by yellow light, medium; and that produced by violet light, least. Sensitizing by previous exposure is greatest in panchromatic plates. With any one plate, it passes through a max. with increasing preexposure. It is thought that the sensitizing effect of previous exposure is caused by the action of optical sensitizers. Cf. Wightman, Trivelli and Sheppard, C. A. 19, 3067; Wightman and Quirk, C. A. 21, 2833; 22, 547. IV. Desensitizing action of previous fogging by x-rays. *Ibid.* 117 25; cf. C. A. 23, 4415.—The destruction of an x-ray exposure by visible light, previously observed by Villard, Wood and others, has been studied in detail. In most com. plates a fog impression produced by x-rays was not reversed by light, but the inertia of the plates was increased. This decrease in sensitivity was independent of the wave length of the light used, and practically so of the time interval between the exposures. The change in sensitivity was greater the higher the speed of the plate, but change in contrast was small for all of them. The decrease in speed produced by a preliminary x-ray fogging was overcome by a second fogging by light; and the gain by a preliminary exposure by light was destroyed by following it by a slight exposure to x-rays before the main exposure. From these facts it was considered that fogging by x-rays and by light is independent of each other.

E. P. WIGHTMAN

The utilization of by-products of saccharin manufacture in photography and photometry. WALTER HERZOG. *Metallhorse* 19, 2191(1929).—A review of the use of *p*-toluenesulfochloride and its derivs. in the prepn. of photographic reagents. W. C. E.

6—INORGANIC CHEMISTRY

A. R. MIDDLETON

Chemistry of tantalum. VICTOR I. SPITZIN AND L. KASHTANOV. *Z. anorg. allgem. Chem.* **182**, 207–27 (1929).—The mineral tantalite and pure Ta in the form of plate were used for materials. K_2TaF_7 is obtained from tantalite by decompn. with concd. H_2SO_4 , pptn. of W and Sn with $(NH_4)_2S_x$ and treatment with HF and KF, followed by sepn. from $K_2C_2O_7$ by repeated crystn. Ta powder obtained by reduction of K_2TaF_7 with Na in H_2 contained no more than 5% O compds. as impurities. The pentoxide, Ta_2O_5 , is obtained as a gray powder by heating Ta plate in the air. If Ta_2O_5 is heated with Mg metal in a Ta boat a vigorous reaction occurs and a lower oxide is formed which always contains combined Mg. It has the probable compn. of $TaO_3 \cdot Mg$ or $Ta_2O_4 \cdot Mg$. The effect of HCl vapors at elevated temps. upon various Ta compds. was studied. At 700° metallic Ta forms $TaCl_5$ and H_2 . The pentachloride sublimes as a yellow powder. Ta_2O_5 reacts with HCl vapor to form $TaCl_5$ and H_2O vapor, but this reaction is quant. reversible at lower temps. At higher temps. a little $TaCl_3$ is formed as well as a stable black oxychloride, TaO_2Cl , and a less stable white substance with the probable compn. $TaOCl_3$. TaO_2Cl can be heated to 1100° before it begins to decompose. By heating TaO_2Cl in a current of dry HCl it is decomposed as follows: $TaO_2Cl + 4HCl = TaCl_5 + 2H_2O$. In the cold part of the app. partial hydrolysis occurs as follows: $2TaCl_5 + 5H_2O = Ta_2O_5 + 10HCl$. H. STOERTZ

The preparation of metallic molybdenum in the laboratory. HANS J. BRAUN. *Metallbörse* **19**, 2190–1 (1929).—In a Hessian crucible are placed 100 g. MoO_3 , 38 g. Al and 50 g. CaF_2 ; this crucible is placed within a larger one, and the space between filled with ordinary Fe thermite mixt. Upon igniting the 2 charges a regulus of very pure (99.6–99.7%) Mo results. By lining the reaction crucible with CaF_2 , the Mo content can be increased to 99.8–99.9%, the remaining portion being Si. W. C. E.

Reclamation of silver from residues. L. C. CASE. *Chemist-Analyst* **18**, No. 4, 14 (1929).—Dissolve the $AgCl$ residues in strong NH_4OH , add a satd. soln. of $Na_2S_2O_4$ and filter off the Ag. Dissolve the metal in HNO_3 and evap. to dryness to get $AgNO_3$. W. T. H.

Preparation and properties of nitryl chloride. H. J. SCHUMACHER AND G. SPRENGER. *Z. anorg. allgem. Chem.* **182**, 139–44 (1929).—Nitryl chloride, NO_2Cl , is obtained by reaction of O_3 upon $NOCl$. The $NOCl$ must be carefully prepd. by action of an excess of dry NO upon dry Cl_2 , followed by careful removal of excess and dissolved NO. After reaction of the $NOCl$ with O_3 , which is quant. complete, the reaction is cooled with liquid air and a colorless, solid mass is obtained. NO_2Cl is a colorless gas of vapor density 2.81 at 100°. It decomposes above 120°, and condenses at -15° and 760 mm. to a heavy colorless liquid. The d. of the liquid at 0° is 1.37. It solidifies at -145° to a white cryst. mass. Sp. heat detns. indicate that association takes place at low temps. H. STOERTZ

Nitryl chloride. Formation and thermal decomposition. H. J. SCHUMACHER AND G. SPRENGER. *Z. Elektrochem.* **35**, 653–5 (1929); cf. preceding abstr.—After prepn. of NO_2Cl , its thermal decompn. was studied by means of a quartz spiral manometer, and was found to be a homogeneous gas reaction of the first order. Conclusion: The decompn. of nitryl chloride is quasimonomolecular, and in the concn. investigated there is a transition zone in which the velocity of decompn. gradually changes from the first to the 2nd order. In monomol. decompn. the primary reaction proceeds according to the equation: $NO_2Cl = NO_2 + Cl$ and the secondary reaction according to the equation $NO_2Cl + Cl = NO_2 + Cl_2$. The effect of NO_2 , Cl_2 , N_2 , O_2 , H_2 and CO upon the reaction is to increase its velocity. H. STOERTZ

Economical and rapid preparation of crystalline lead iodide. ENRICO TOGNOLÀ. *Boll. chim. farm.* **48**, 639–40 (1929).—A boiling soln. of 250 g. $AcONa$ in 750 cc. of H_2O , which is slightly acidified with $AcOH$, will dissolve 70 g. of PbI_2 . On cooling cryst. PbI_2 seps. G. SCHWOCH

Basic acetate and sulfate of gallium and gallium oxalate. ARAKEL TCHAKIRIAN. *Compt. rend.* **189**, 251–2 (1929).—If a soln. of a Ga salt, previously neutralized with $(NH_4)_2CO_3$, is treated with excess $AcOH$, there is obtained on standing a white, microcryst., slightly sol. compd. having the formula $4Ga(CH_3COO)_3 \cdot 2Ga_2O_3 \cdot 5H_2O$. The compd. is hygroscopic and decomposes at 160°. If a soln. of $Ga_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$ contg. 10% H_2SO_4 is heated, there is obtained a ppt., sol. in the cold, having the formula $3(NH_4)_2SO_4 \cdot 3Ga_2(SO_4)_3 \cdot 5Ga_2O_3 \cdot 16H_2O$. By heating $Ga(NO_3)_3$ with $H_2C_2O_4$

and HNO_3 the compd. $\text{Ga}_2(\text{C}_2\text{O}_4)_3 \cdot 4\text{H}_2\text{O}$ is obtained; this is a white, slightly sol., hygroscopic salt, decomp. at 160° . E. G. VANDEN BOSCH

A method for the preparation of pure cupric sulfide. KURT FISCHBECK and OSKAR DORNER. *Z. anorg. allgem. Chem.* 182, 228-34(1929).—Pure Cu powder, prepd. by decompn. of the oxalate in an atm. of H_2 , is finely ground in a mortar and covered with CS_2 . Slightly more S than is required for CuS is dissolved in considerable CS_2 and this soln. is added slowly with const. stirring. While still moist, the reaction product is introduced into a pressure tube, covered with about twice as much S as is needed for CuS and the tube filled with CS_2 and rumbled for 4 hrs. in a drum filled with steam. The product of the reaction is filtered, washed with CS_2 , and the sulfide finally dried for 1-2 hrs. in a vacuum at 90-100°. Analysis showed the product to be quite pure CuS , the S content in no case exceeding the theoretical, thus excluding any probability of a polysulfide formation. The sulfide has a beautiful, dark blue color, is a very good elec. conductor, and dissolves in KCN without yielding any residue. H. STOERTZ

Preparation and properties of a bromine oxide. BERNARD LEWIS and H. J. SCHUMACHER. *Z. anorg. allgem. Chem.* 182, 182-6(1929), cf. *C. A.* 23, 3416.—If carefully purified Br_2 under 3-15 mm. pressure is allowed to react with 10-15 times as much O_3 at -5 to $+10^\circ$, an oxide of Br is formed having the compn. $(\text{Br}_2\text{O}_3)_n$. Only by keeping the temp. of the reaction low and carefully avoiding too much O_3 or Br_2 can explosions be avoided. The oxide is unstable except at very low temps. or in the presence of O_2 . It occurs in 2 modifications. By long cooling at -40° , the oxide is obtained in the form of fine white needles, which are more stable than the usual form resembling snow flakes. The new oxide is sol. in H_2O with formation of a colorless soln. contg. no free Br_2 . No Br ions are present but titration with $\text{Ba}(\text{OH})_2$ shows more H ions than correspond to the Br. The H_2O soln. seps. 1 from strongly acid KI soln. Titration of the sepd. I_2 indicates that the H_2O soln. probably contains the acid $\text{H}_4\text{Br}_2\text{O}_6$, the following decompn. being indicated: $\text{H}_4\text{Br}_2\text{O}_6 \rightarrow 2\text{HBrO}_3 + \text{H}_2\text{BrO}_4$ and $2\text{H}_2\text{BrO}_4 \rightarrow \text{HBr} + \text{HBrO} + \text{H}_2\text{O}_2$. The existence of an intermediate oxide of Br which is unstable in the presence of O_2 is indicated. H. STOERTZ

The action of alkali carbonate on lead chloride. MME N. DEMASSEUX. *Compt. rend.* 189, 333-5(1929).—The reaction of Na_2CO_3 and PbCl_2 was followed by means of cond. measurements. Up to 0.5 mol. Na_2CO_3 , the chlorocarbonate ("phosgenite") is pptd.; from 0.5 to equimol., the ppt. is a mixt. of chlorocarbonate and PbCO_3 ; beyond, it is PbCO_3 alone. T. H. CHILTON

The exchange reaction of insoluble alkaline earth phosphates with permutites and clay. E. UNGERER. *Kolloid Z.* 48, 237-41(1929).—K and NH_4 permutites were freed as much as possible from CaO by leaching with a corresponding chloride for many days. Their reaction with $\text{Mg}(\text{PO}_4)_2 \cdot 2\text{H}_2\text{O}$, $\text{MgNH}_4\text{PO}_4 \cdot 6\text{H}_2\text{O}$ and $\text{Ca}_3(\text{PO}_4)_2$ was studied. Base exchange takes place, producing free H_2PO_4^- . It is possible to reverse the action of tertiary phosphates of the alk. earths on univalent permutites. The reversible action is similar to that of the silicates in soil. The reaction, therefore, has significance in the transformation of soil phosphates in soil. R. H. LAMBERT

The behavior of molten tellurium oxide and its salts upon rare metals heated to high temperatures electrically. A. SIMER. *Chem. Listy* 23, 420-2(1929).—Drops of molten TeO_2 move from the neg. to the pos. pole upon a surface of hot Pt. No other combination of liquid and metal has been found to act similarly. The addn. of TeO_2 to molten salts, alkali chlorides or sulfates, pyrophosphate, tungstates, changes the angle of contact and motion of the drops into the same direction as that of the TeO_2 . A decrease in the TeO_2 concn. reverses the behavior of the drops. At min. low temps. the motion may persist for hrs. before the drops come to a standstill. The quantity of TeO_2 is a few hundredths %. The metals, Ni, Ag, Rh, Pd, Au and Ir, do not show this movement of TeO_2 drops. On Pt the drops of TeO_2 become yellow to a yellow-brown, suggesting a compd. formation. FRANK MARESH

Reactions between ferrous compounds and nitric oxide. L. CAMBI and A. CLERICI. *Atti accad. Lincei* 9, 519-23(1929).—When a soln. of FeSO_4 at 0° is satd. with NO (atm. of NO) and then alkali ($\text{NaOH} = 1\text{ N}$, 2 N ; $\text{KOH} = 2\text{ N}$) added, a black ppt. is formed which rapidly assumes a reddish color, with frothing and development of gas, which was found to consist of N_2 and N_2O . At the same time some Fe^{++} changes to Fe^{+++} . A. W. CONTIERI

The action of hydrogen sulfide on solutions of nitric acid. H. B. DUNNCLIFF and SARDAR MOHAMMAD. *J. Phys. Chem.* 33, 1343-62(1929).— H_2S reacts with solns. of HNO_3 above 5% in concn. after an induction period which depends on the concn., and which may be shortened by addn. of N oxides. The products formed include S , H_2SO_4 , HNO_2 , NO , N_2 and NH_3 . Mechanisms are discussed to account for the appearance

of each of these products. The initial presence of H_2SO_4 increases the induction period, and 15% H_2SO_4 with 23% HNO_3 stops the reaction completely. T. H. CHILTON

The reduction of hydrazoic acid with hydrogen in the presence of colloidal palladium. Preliminary note. B. RICCA AND F. PIRRONI. *Gazz. chim. ital.* 59, 379-84 (1929).—A survey of the literature on the reduction of HN_3 by various reducing agents shows that the products obtained depend upon the reducing agent employed, NH_3 always being formed with either H or N_2H_4 as the 2nd product. In the present paper, HN_3 was reduced by nascent H and by mol. H with colloidal Pd as catalyst. H was bubbled into a mixt. contg. PdCl_2 , gum arabic and HCl in aq. soln., and the NH_3 and N_2H_4 were detd. In the nascent-H expts., the same solns. were used, only Zn in excess of that calcd. for the reduction was added and then dil HCl. Under each set of conditions, the reduction proceeded chiefly according to the reaction: $\text{HN}_3 + 6\text{H} \rightarrow \text{NH}_3 + \text{N}_2\text{H}_4$. When the medium was alk. with NaOH instead of acidic, there was no appreciable reduction. C. C. DAVIS

[Reaction between] sulfuric and hydriodic acids. FLORENCE BUSH. *J. Phys. Chem.* 33, 613-20 (1929).—Expts. are described and discussed. With a relatively low concn. of HI the H_2SO_4 is reduced to H_2SO_3 , and with a high concn. to H_2S . The relative amts. of H_2SO_3 , H_2S and S produced vary considerably with the size of the crystals of KI dropped into the concd. H_2SO_4 and with the rate of stirring of the soln. B. C. A.

Action of hydrazine upon arsenic acid in slightly acid solution. II. H. KUBINA. *Z. anal. Chem.* 78, 1-36 (1929).—When N_2H_4 reacts with As^{V} the normal reduction product is As^{III} but if the soln. is about 1.5 N in HCl there is an appreciable quantity of free As formed. In this paper numerous expts. are described which seek to explain the reaction. The hypothesis is suggested that As^{III} is the primary product and that it reacts with As^{V} to form As^{IV} . This reacts with N_2H_4 to form As^{III} and some diimide and also with H_2 to form AsH_3 , which then reacts with As^{III} to form free As. W. T. H.

Ortho- and pyrosilicic acid. P. A. THIESSEN AND O. KOERNER. *Z. anorg. allgem. Chem.* 182, 343-50 (1929).—By slow hydrolysis of ethyl orthosilicate, the orthosilicic acid, $(\text{SiO}_2 \cdot 2\text{H}_2\text{O})$, is prepd. By withdrawal of H_2O from this, pyrosilicic acid, $(2\text{SiO}_2 \cdot 3\text{H}_2\text{O})$, is formed, and by further dehydration the already known metasilicic acid, $(\text{SiO} \cdot \text{H}_2\text{O})$. The hydrates were identified by plotting vapor pressure- H_2O concn. isotherms. H. S.

Investigation of alkali-aluminum silicates. I. Synthetic study of nephelines. ERHARD GRÜNER. *Z. anorg. allgem. Chem.* 182, 319-31 (1929). Nephelines are minerals having the general compn. $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2$ and crystg. in the hexagonal system. The synthesis of these from mica and alkalis in H_2O medium was studied. The lowest temp. at which nepheline formation occurred was about 200° , and the reverse formation of mica and alkali from nepheline and H_2O occurs only above 400° . In the action of Na_2CO_3 upon kaolin at $800-1000^\circ$, 2 silicates were formed: nepheline and $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{Na}_2\text{O}$. The latter, on heating with H_2O , exchanges Na_2O for H_2O and forms a nepheline monohydrate, $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot \text{Na}_2\text{O} \cdot \text{H}_2\text{O}$, which is stable. H. STOERTZ

Double sulfates and their components. V. Aluminum and chromium alums. F. KRAUSS, A. FRICKE AND H. QUERENGASSER. *Z. anorg. allgem. Chem.* 181, 38-54 (1929).—Pure Cs, Rb and K Al alums and K Cr alum were prepd. By means of isobaric decompns. (Huttig method), computations of the heats of formations by the Nernst formula, and density measurements, it is shown that the alums fall into 2 classes. Of those studied the first 3 belong to type A and the last belongs to type B. A. L. H.

Oxidation of complex compounds of platinum. II. Oxidation with persulfate and free oxygen. I. CHUGAEV AND I. CHERNYAEV. *Z. anorg. allgem. Chem.* 182, 159-72 (1929); cf. C. A. 20, 1765.—If Peyrone's salt is treated with $(\text{NH}_4)_2\text{S}_2\text{O}_8$ in the absence of K_2PtCl_6 , the reaction mixt. becomes black and a ppt of short needles is formed having the compn. $[\text{Pt}(\text{NH}_3)_2\text{PtCl}_6(\text{OH})]$ (I). A similar compd. is formed with HF or any acid capable of forming peroxidation compds. if H_2O_2 is added to the acid. If one heats a mixt. of $[\text{Pt}(\text{NH}_3)_2\text{PtCl}_6]$ and $[\text{Pt}(\text{NH}_3)_2\text{PtCl}_6(\text{OH})_2]$ with H_2O acidified with a few drops of H_2SO_4 , Peyrone's salt and the black compd. of Pt^{III} are formed. Alkalies and NH_3 decompose I instantly. The oxidation coeff. of Pt in I is detd. by reduction with Zn and HCl and has the value of approx. 3.00. When Peyrone's salt is treated with persulfate in the presence of K_2PtCl_6 , long needles of a reddish brown color are obtained, which appear bright blue in transmitted light. The structure of this compd. is somewhat indefinite, but the presence of an ion $[\text{PtCl}_6]^{4-}$ and 2 ions each with one atom of Pt^{III} is indicated. The oxidation coeff. is 2.64 and the compd. is decompd. by NH_4OH , HCl or hot H_2O but is not attacked by cold H_2O , alc. or Et_2O . II $[(\text{CH}_3)_2(\text{NH}_2)_2\text{PtCl}_6]$

dation. Slight variations in the readings of the direct method are caused by varying agitation. The direct process is quicker, easier and more suitable for the study of pure substances, sewage sludge and trade wastes. W. T. H.

Application of the Seliwanoff test. R. OFNER. *Chem.-Ztg.* **53**, 682-3(1929).—The test referred to is based upon the pink color which is obtained by heating an aq. sugar soln. with resorcinol and HCl. Unless care is taken in making the test, a color may be obtained when no fructose or saccharose is present. It is best to take an ordinary test tube, add 5 cc. of the colorless sugar soln. contg. not more than 3% of sugar and 5 cc. of soln. made by dissolving 0.5 g. of pure resorcinol in 100 ml. of 24% HCl. Add a little powd. pumice, boil exactly 20 sec., place in cold water and exam. after standing 2 min. Under these conditions 1 mg. of fructose will give a color and so will 2 mg. of saccharose. W. T. H.

Prevention of bumping during boiling. HENRY L. SKINNER. *Chemist-Analyst* **18**, No. 5, 8(1929).—The addn. of a little H_2O_2 is sometimes more effective than glass beads. W. T. H.

A dust problem. H. SPURRIER. *Chemist Analyst* **18**, No. 5, 10 11(1929).—The method used for detg. the quantity of impalpable clay dust in a certain plant is described. W. T. H.

New indicators. R. FRESSENIUS. *Z. angew. Chem.* **42**, 892-5(1929).—A lecture discussing some of the recent contributions in this field. W. T. H.

Stabilized starch indicator. M. STARR NICHOLS. *Ind. Eng. Chem., Anal. Ed.* **1**, 215-6(1929).—To 50 g. of potato starch add 250 cc. of cold water and triturate to a thin paste. Pour it gradually with stirring into 20 l. of boiling water. Cool and add 25 g. of salicylic acid. Use 2 cc. in a titrating vol. of 200 cc. W. T. H.

Oxamide; a nickel reagent. JAROSLAV LIŠKA. *Chem. Listy* **23**, 402-3(1929).—The addn. of a dil. Ni soln. to oxamide followed by a concd. alkali gives a yellow coloration—a biuret reaction. The intensity and shade of the yellow is dependent upon the org. matter used. Oxamide gives a very intense color due to its insolv. Oxamide is added to a test tube (about 1 cc. of the powder which is difficultly sol. in H_2O , EtOH and ether) and brought to a boil with 1 cc. $NiSO_4$. Concd. NaOH is added to the mixt.; a yellow color appears immediately and fades with time and standing. Boiling with NaOH is to be avoided; the oxamide undergoes cleavage. Finely ground $Ba(OH)_2$ or CaO may be mixed in equal quantities with the oxamide; it replaces the NaOH. The reaction appears to be specific for Ni; it fails when cations are present, which yield colored hydroxides. The NiS and CoS are pptd. with $(NH_4)_2S$ and sepd. In aqua regia the ppt. is dissolved; the Co is pptd. as $Co(NO_3)_2 \cdot 6H_2O$ with KNO_3 and filtered off. The filtrate is made acid with H_2SO_4 and boiled if a yellow color is present; the colorless filtrate is used as above. The reaction is less sensitive than that of Chugaev; it cannot be used for the quant. detn. of Ni. FRANK MARESH.

Dimethylglyoxime as indicator in nickel titration. H. WILHELM. *Metallwarenen-Ind. Galvano-Tech.* **27**, 231(1929).—Before titrating a Ni soln. with KCN, add 5 cc. of 5% NH_4 tartrate soln. and 5 cc. of 6 N NH_4OH . Run a preliminary titration, stopping when the blue color of $Ni(NH_3)_4$ has changed to bright yellow. Repeat the titration using a 1% soln. of dimethylglyoxime in alc. as an outside indicator. If Zn is present add 20 cc. of 15% NaOH at the start. GUSTAF SODERBERG.

Prevention of over-titration. A. H. MOONEY. *Chemist Analyst* **18**, No. 5, 11(1929). By having a tube in the soln. with its end closed by rubber tubing and a pinch cock, the soln. in this tube does not come in contact with the titrating agent to any extent. Toward the end of the titration, this tube is removed and washed out. W. T. H.

Use of end point electrodes in potentiometric titrations. Potentiometric determination of potassium. ANTS LAUR. *Acta Comm. Univ. Tartuensis (Dorpatensis)* **16A**, No. 2, 66 pp. W. T. H.

Rapid method for detecting the elements of groups II-IV by means of several organic reagents. P. AGOSTINI. *Ann. chim. applicata* **19**, 161 73(1929).—All the elements whose chlorides are sol. in HCl, i. e., Pb, As, Sb, Sn, Hg, Bi, Cu, Cd, Fe, Al, Cr, Mn, Zn, Co and Ni, are included, and tests for the detection of each in the presence of the rest, as well as a systematic scheme of analysis are presented. The reagents used are alizarin S, 1% aq. soln.; α -nitroso- β -naphthol, 50% AcOH soln.; benzidine, AcOH soln.; cupferron, aq.; cupron, warm EtOH; dimethylglyoxime, 1% EtOH; KI + $SnCl_2$ + $C_6H_5NH_2$, aq.; pyrogallol, aq.; Bettendorff reagent, satd. soln. of $SnCl_2$ in HCl; resorcinol, EtOH concd.; rhodamine B, 0.05 g. in $1/2$ l. H_2O ; tetroxanthraquinone, 10 mg. in 50 cc. EtOH; and 5% NaOH. An HCl soln. which does not contain any CN, $Fe(CN)_6$, SCN, I, Br, NH_4 , CrO_4 or org. matter is prepd. Ifg. Add H_3PO_4 and heat, then

Hg_2Cl_2 and Hg will ppt. *As.*—Add Bettendorff reagent; an eventual black ppt. is formed; Hg interferes and must first be removed with 5% NaOH. *Cu.*—(I) Add SO_2 to original soln., filter off Hg_2Cl_2 and add KSCN, which gives white CuSCN; or (II) add NH_4OH , filter, and add cupron (oxybenzoin), which forms a bulky green, amorphous ppt. *Fe.*—Add HNO_3 and boil, add NaOH, collect ppt., dissolve in HCl and HNO_3 , boil and add pyrogallol; an intense red coloration denotes Fe. *Co.*—Add several drops of α -nitroso- β naphthol; a bulky scarlet-red ppt., $\text{C}_{10}\text{H}_8(\text{NO})_2\text{Co}$ is formed. Cu and Fe interfere so these must first be removed, using cupferron. *Mn.*—Dip a piece of filter paper into the soln., then in NaOH and in benzidine; a deep blue stain results. Large amts. of Co interfere, in which case it is pptd. with α -nitroso- β -naphthol. *Bi.*—Add NaOH soln. in excess and remove the ppt. Then dissolve a small portion of the ppt. in HNO_3 , evap., redissolve in H_2O and add a drop of KI-SnCl₂ and $\text{C}_6\text{H}_5\text{NH}_2$ soln. on a watch glass. A yellow to salmon-red color is obtained, which is not destroyed by KSCN. *Ni.*—Add NH_4OH to the original soln., filter off the ppt. and test the filtrate with EtOH soln. of dimethylglyoxime, which gives a scarlet coloration or ppt. Large quantities of Co obscure the test; therefore, this is oxidized in NH_4OH to form cobalt-ammonium compds. *Cd.* Add $\text{H}_3\text{P}_2\text{O}_7$ to original soln. to ppt out Hg; then add NaOH in excess, filter on suction filter and wash till the filtrate does not react with H_2S . Then redissolve the ppt. with HCl and add excess NH_4OH . Remove Cu with cupron and then treat the acidified filtrate with H_2S . Yellow CdS is obtained. *Pb.*—Add H_2SO_4 (1:5), redissolve the pptd. PbSO_4 in ammonium tartrate, and then after adding AcOH test the soln. with $\text{K}_2\text{Cr}_2\text{O}_7$ as usual. *Al.*—Neutralize the original soln. with concd. NaOH, add excess 5% NaOH and filter the ppt. To 5 cc. of the acidified filtrate (with HCl) add 1 cc. of 1% alizarin S (sodium sulfonate of alizarin) and then add NH_4OH till the soln. turns red to purple. Boil, cool and acidify with AcOH. If the coloration persists or a red ppt. forms, Al is present. *Zn.*—Add concd. NaOH to the original soln. till it is neutral and then add excess 5% NaOH. Make the acidified filtrate (HCl) faintly alk. (NH_4OH), filter if necessary, add to 5 cc. filtrate 1 cc. resorcinol soln. (in EtOH) and heat. Blue coloration denotes Zn. *Sb.*—Neutralize with NaOH, add excess 5% NaOH, heat and filter. To 5 cc. acidified (HCl) filtrate add NaNO_2 (to oxidize Sb^{III} to Sb^{V}). Then add a drop of rhodamine B, which gives a violet color with yellow-red fluorescence. *Sn.*—Neutralize, add excess 5% NaOH and filter. Add HCl in excess and test with cupferron. A bulky white ppt. is formed (probably Sn ($\text{C}_6\text{H}_5\text{N}_3\text{O}_2$)₄). *Cr.* Fuse the powd. sample with KNO_3 and Na_2CO_3 . Dissolve, add H_2O_2 (1 cc.), H_2SO_4 and 1 cc. Et₂O and shake. The ether layer is colored blue by Cr. In the latter part of the paper a systematic scheme for the detection of the above elements is given.

A. W. CONTIERI

Determination of aluminum in plants. I. Study of the use of aurintricarboxylic acid for the colorimetric determination of aluminum. O. B. WINTER, W. E. THRUN AND O. D. BIRD. *J. Am. Chem. Soc.* 51, 2721-31 (1929).—Some difficulties were encountered in carrying out the colorimetric detn. with aluminum by previously described methods. The conditions were studied carefully and the method was modified so that 0.005-0.079 mg. of Al can be compared with a standard and the amt. of Al read directly from a curve. Max. color was obtained in the presence of 10% NH_4OAc when the soln. was kept at 80° for 10 min. and at p_{H} = approx. 4. In the presence of 25 milliequiv. of both NH_4OAc and NH_4Cl , the dye changed color at p_{H} = about 7. A neutral or alk. soln. of 2 cc. of 0.1% dye in a vol. of 50 cc. was nearly colorless. The lake color was sufficiently permanent for color comparison until the p_{H} was raised to 7.4. NH_4OAc and NH_4Cl were found to be advantageous for controlling the acidity and $(\text{NH}_4)_2\text{CO}_3$ was found more advantageous for decolorizing the excess dye than either NH_4OH or NH_4OH and $(\text{NH}_4)_2\text{CO}_3$. **II. Aluminum in plant materials.** O. B. WINTER AND O. D. BIRD. *Ibid.* 2964-8.—Some 76 samples of plant materials were tested and Al was found in every one. A method of preparing samples for colorimetric detn. of Al with aluminum is described.

W. T. H.

Estimation of antimony in commercial arsenic. LINDSAY G. ARMSTRONG. *Chem.-ist Analyst* 18, No. 4, 8 (1929).—The method calls for dissolving the metal in strong HCl, adding Na_2SO_3 , evap. to distil off AsCl_3 and finally titrating the SbCl_3 with KBrO_3 .

W. T. H.

The influence of lead on the titration of antimony with permanganate in the analysis of white metals. A. A. VASIL'EV AND H. STUTZER. *Z. anal. Chem.* 78, 97-102 (1929).—On account of adsorption of Sb by the PbSO_4 ppt., the results are low unless the ppt. is dissolved and the Sb in it titrated. When the first titration with KMnO_4 is finished, carefully pour off the soln. and dissolve the ppt. of PbSO_4 by heating with 20 cc. of concd. HCl and 10 cc. of water. Add 400 cc. of water and titrate again with KMnO_4 . The

Magyar Chem. Folyóirat 35, 59-62(1929).—The method described is based on the known fact that $\text{Ca}(\text{NO}_3)_2$ when anhydrous is sol. in abs. alc. and in isobutyl alc. whereas anhydrous $\text{Sr}(\text{NO}_3)_2$ is not.

S. S. DE FINÁLY

Determination of calcium and barium in the presence of each other. LÁSZLÓ SZEBELLÉDY. Magyar Chem. Folyóirat 35, 63-4(1929).—In this case the same method can be used as was proposed to separate Ca and Sr (preceding abstract). The identity of CaSO_4 can be proved by microchemical, that of $\text{Ba}(\text{NO}_3)_2$ by spectroscopical methods.

S. S. DE FINÁLY

Detection of cobalt and nickel in the presence of phosphates and of magnesium in the presence of cobalt and nickel. ROMOLO ROSSI. Ann. chim. applicata 19, 255-60(1929).—When NH_4OH is used to ppt. metals of the third group (in the presence of PO_4 ion), in boiling off the excess NH_4OH , Co and Ni may be pptd., the Co especially. These metals afterwards may be mistaken for Mg. Therefore, Co and Ni should be tested for in the third group to insure their absence.

A. W. CONTIERI

Electrometric determination of copper. I. Müller and Rudolph's method. MARJORIE E. PRING AND JAMES F. SPENCER. Analyst 54, 509-16(1929).—The method consists in reducing the cupric salt with NaHSO_3 and titrating with KCNS , using a Cu electrode. Expts. showed that the titration is very sensitive to changes in temp., concn. of the reducing agent and time taken. There is no const. error so that a correction factor does not remedy the difficulty entirely.

W. T. H.

Iodometric determination of copper. E. H. SMITH. Chemist-Analyst 18, No. 4, 67(1929).—The method is similar to that in common use, pptg. the Cu as CuS by $\text{Na}_2\text{S}_2\text{O}_8$, roasting the ppt., dissolving in HNO_3 , etc., but enough KI is added at the end to keep the CuI_2 dissolved as complex iodide in order to sharpen the end point.

W. T. H.

Determination of copper with 5,7-dibromo-8-hydroxyquinoline. L. W. HAASE. Z. anal. Chem. 78, 113-24(1929). To prep. the reagent, dissolve 10-20 g. of 8-hydroxyquinoline in pure CHCl_3 , cooling in ice. Separately dissolve a little less than the equiv. quantity of Br_2 in cold CHCl_3 . Add the latter soln. dropwise to the former, while shaking. As soon as the chrome-yellow ppt. has settled well and the supernatant liquid is a pale yellow, add more Br_2 from a pipet until the dibromo substitution product is formed and a slight excess of Br_2 is shown by the color of the soln. Filter and wash on the suction plate with cold CHCl_3 until all excess Br_2 has been removed. Dry by suction and ext. with alc. in a Soxhlet app. Recrystallize from hot benzene until the crystals are nearly colorless and the benzene soln. is quite so. The reagent is obtained by making a 0.5% soln. in 5 N HCl. To det. Cu in quantities ranging from 5-10 mg. per l., 2-3 ml. of the reagent is sufficient. It is particularly suitable for detg. Cu in waters which have been treated with Cu salt to remove algae. To 200 cc. of the water, add 1 cc. of N HCl and about 10 drops of perhydrol and boil until the soln. is colorless. Filter, add 2 cc. of reagent, filter off the ppt., dry 1 hr. at 105° and 2 hrs. at 150° . The ppt. corresponds to the formula $\text{C}_{17}\text{H}_7\text{Br}_2\text{N}_5\text{Cu}$. The heating at 150° serves to volatilize excess reagent.

W. T. H.

Determination of iron and copper in antimonial lead alloy. ALLEN H. BLANC, JR. Chemist-Analyst 18, No. 4, 5(1929).—The sample is dissolved in strong H_2SO_4 ; in about parts of the diluted soln. Fe is detd. colorimetrically as $\text{Fe}(\text{CNS})_3$ and Cu colorimetrically as $\text{Cu}(\text{NH}_4)_4^{++}$.

W. T. H.

Quantitative analysis of gallium. III. ALFRED BRUKL. Monatsh 52, 253-9(1929), cf. C. A. 23, 3185. To sep. Ga from Ti neutralize the soln. with NH_4OH and add an excess of $(\text{NH}_4)_2\text{C}_2\text{O}_4$. Then make the soln. N in oxalic acid and ppt. the Ti in the cold with cupferron. Ignite and weigh as TiO_2 . In the filtrate destroy the oxalate by heating with H_2O_2 and H_2SO_4 , evap. to fumes. Then dil. and ppt. Ga with cupferron in the cold. Or, instead of cupferron, phenylarsonic acid may be used, but the recommended procedure is much more complicated. For the sepn. of Zr from Ga the procedures are similar. The sepn. of Ga from Th can also be effected in these ways and large quantities of Th can be pptd. as oxalate in the absence of SO_4^{--} . To sep. Ga from V it is recommended to ppt. Ga from ammoniacal soln. by means of 8-hydroxyquinoline. In the filtrate, the V can be pptd. by neutralizing with AcOH very carefully and boiling with 1 cc. of satd. $(\text{NH}_4)_2\text{CO}_3$ soln. until the soln. is neutral to litmus. Dissolve the ppt. in 2 N H_2SO_4 and ppt. with cupferron. The sepn. of Ga from W can be accomplished similarly. The sepn. of Ga from rare earths can be accomplished with cupferron.

W. T. H.

Iodometric determination of iron. ERNEST H. SWIFT. J. Am. Chem. Soc. 51, 2682-9(1929).—The conditions governing the dependability of Mohr's well-known method were studied and it was found that an accuracy of 0.2% can be obtained when

the reaction between FeCl_3 and KI takes place during 5 min. in a closed flask contg. 30 ml. of soln., 3 g. of KI and 0.25–25 milli-equiv. of HCl . The soln. should then be dild. to 100 cc. and titrated with $\text{Na}_2\text{S}_2\text{O}_8$. Correct results are due to a compensation of errors due to incomplete reduction and atm. oxidation. When H_2SO_4 is used in place of HCl , more acid is required and more KI , but even then the end points are less permanent. W. T. H.

Potentiometric method for the determination of iron and molybdenum. H. BRINTZINGER AND W. SCHIEFERDECKER. *Z. anal. Chem.* 78, 110 (1929).—To the soln. add 30 g. of CaCl_2 crystals, 25 cc. of concd. HCl and water to make 100 cc. Boil in a stream of CO_2 to remove dissolved O_2 and titrate with 0.1 N CrCl_3 at about 90° . The first break in the titration curve corresponds to the reduction of Fe^{III} to Fe^{II} and of Mo^{VI} to Mo^{V} . A second and equally distinct break corresponds to the reduction of Mo^{V} to Mo^{III} . W. T. H.

Titrimetric determination of iron with potassium permanganate and dyes. JOSEF KNOP AND OLGA KUBELKOVA. *Chem. Listy* 23, 399–402 (1929).—The triphenylmethane dyes Erioglaucine A and Eriogreen B, made by J. R. Geigy in Basel are suitable for a manganometric detn. of ferrocyanides as reversible oxidimetric indicators. Fe solns. were titrated with KMnO_4 in an atm. of SO_2 . From titration figures it follows that the microtitration of Fe with the above indicators is an exact method; in microtitration, the error of detn. in a 1 mg. sample of Fe was 0.5% and less. This error can be reduced to 0.1%; the method will be published later. FRANK MARESH

Determination of iron by means of ether. TIHAMÉR SZAFFKA. *Magyar Chem. Folyóirat* 35, 44–51 (1929).—For the removal of FeCl_3 by the well-known Rothe method the best results were obtained when the aq. soln. contained 20.6% HCl gas by wt. S. S. DE FINÁLY

Rapid electrolytic method for the determination of lead as lead dioxide. HERBERT TÖPELMANN. *J. prakt. Chem.* 121, 289–319 (1929). Good results are obtained with as much as 0.4 g. of Pb if the electrolysis takes place at room temp. in 100 cc. of soln. contg. 0.125–0.160 equiv. of HNO_3 and 1–2 g. of $\text{Cu}(\text{NO}_3)_2$ using a Pt gauze anode and a rotating Pt anode making 500 r. p. m. Start the electrolysis with a current of 0.5 amp. and gradually increase it so that after 15 min. a current of 2 amp. is flowing. After another 15 min. remove the electrolyte and wash the deposit carefully without breaking the circuit. All but about 0.06 mg. of Pb will be deposited from the soln. Dry at 260° for 30 min. The deposit contains 85.80% Pb . W. T. H.

Electrolytic board for the determination of lead with comments on the procedure for determining lead in low-grade tailings of the southeast Missouri lead district. O. W. HOLMES AND D. P. MORGAN. *Ind. Eng. Chem., Anal. Ed.* 1, 210 (1929).—A cabinet is described and pictured which permits the simultaneous detn. of Pb or Cu in 24 samples. The method used is the following: Weigh out 0.886 g., or some multiple of this wt., and digest the ore with 25 cc. of concd. HNO_3 . When no more red fumes are evolved, wash down the sides of the beaker with 15–20 ml. of 22.5% NH_4NO_3 soln. Dil. to 145 ml. and electrolyze 2 hrs. at 70–80° with a c.d. of 2 amp. at 15 v. If the Pb content is less than 10 mg., first add 25 ml. of $\text{Pb}(\text{NO}_3)_2$ soln. equiv. to 0.0048 g. of PbO_2 . If more than 7% Pb is present the molybdate titration is preferred. W. T. H.

New separation of lead and bismuth by means of organic hydrochlorides. I. FRICK AND ENGEMANN. *Chem.-Ztg.* 53, 601 (1929).—Cinchonine-HCl will serve to ppt. Bi in the presence of Pb . In this way a more rapid sepn. can be accomplished than by means of other methods, when the content of the Bi is very small. Neutralize the soln. with NaOH until it shows a bluish red tint with Congo red, add 20 cc. of 0.7% cinchonine-HCl soln. in water and filter after 30 min. If the filtrate shows a red test with KI soln., the soln. was too acid. Dissolve the ppt. in HNO_3 and det. the Bi by one of the usual methods. W. T. H.

Determination of manganese in steel by the method of Wald. J. KASLER. *Chem.-Ztg.* 53, 719 (1929).—The method of W. was published in 1892 and is excellent for the detn. of Mn in alloy steels except when Co is present. As little as 0.2% Co makes the method unreliable but otherwise it is good to 0.005% Mn . However, if Co is present, the MnO_2 ppt. appears black so that there is no danger of error from assuming that no Co is present. The method consists in pptg. Mn as MnO_2 in a buffered soln. by means of a known vol. of KMnO_4 . The excess KMnO_4 is then reduced to MnO_2 and the total Mn titrated iodometrically. The procedure is as follows: Treat 2.75 g. of steel with 50 cc. of hot 6 N H_2SO_4 . When the sample has dissolved, add 10 cc. of 6 N HNO_3 and boil a few minutes to oxidize the Fe . Ppt. the Fe with ZnO , filter and take an aliquot for further work, as in the Volhard detn. To 100 cc. of filtrate, add 20 cc. of 25% NaOAc soln., heat to boiling and add 0.005 molar KMnO_4 from a buret

until a distinct excess is noticeable. Then, to reduce the excess KMnO_4 , add 5 cc. of 10% alc., boil 2-3 minutes and repeat this treatment with 2 more portions of alc., finally boiling 5 min. to remove all AcH . Cool, add 200 cc. of cold water, 10 cc. of 5% KI soln. and 20 cc. of 6 N HCl . Titrate the liberated I_2 with 0.02 N $\text{Na}_2\text{S}_2\text{O}_3$ using starch as indicator.

W. T. H.

Volumetric determination of manganese as dioxide with special reference to the application of potassium bromate as oxidizing agent. I. M. KOLTHOFF AND ERNEST B. SANDELL. *Ind. Eng. Chem., Anal. Ed.* 1, 181-5 (1929).—The methods described depend upon the pptn. of MnO_2 in acid soln. by either persulfate or bromate followed by iodometric titration of the MnO_2 . The results with KBrO_3 were, on the whole, better than those with $\text{K}_2\text{S}_2\text{O}_8$, although in both cases it was found necessary to use an empirical factor. Directions are given by which accurate results can be obtained.

W. T. H.

Determination of mercury in amalgamated zinc. ALFRED KUNDERT. *Chemist-Analyst* 18, No. 5, 6 (1929).—The method depends upon soln. of the Zn in HCl , dissolving the residue in HNO_3 and Br_2 , pptg. Pb as basic carbonate, washing this ppt. with 1% NaCN soln. and finally pptg. the Hg as HgS , in which form it can be weighed.

W. T. H.

Determination of small quantities of mercury. J. BODNAR. *Z. angew. Chem.* 42, 826 (1929).—Attention is called to a previous paper (*C. A.* 23, 2903).

W. T. H.

Determination of traces of mercury. R. THULENIUS AND R. WINZER. *Z. angew. Chem.* 42, 941 (1929).—The work of Bodnar and Szép (*C. A.* 23, 2903) escaped attention at the time the work of T. and W. was published (*C. A.* 23, 3183) and certainly deserves priority credit. In some ways the procedure is different and expts. are now being made to see which is better.

W. T. H.

Determination of small quantities of selenium in ores. E. THEODORE ERICKSON. *J. Wash. Acad. Sci.* 19, 319-21 (1929).—Mix 25 g. of ore with 80 g. of a mixt. of 3 parts ZnO and 1 part Na_2CO_3 . Add another 80 g. of the mixt. and heat slowly in a muffle to about 700° . During the following hr. stir several times with a spatula and raise the temp. to 750° . Finally heat at 800° for an hr. Cool slowly and ext. with hot water until 900 cc. of aq. soln. is obtained. Evap. to 20 cc., add 25 cc. of concd. HCl and triturate in a mortar. Filter and triturate again with 20 cc. of acid. Sat. with H_2S allow to stand overnight, sat. again with SO_2 and again with the gas to form Se . For the most delicate indications of color, repeat this treatment 2-3 times during 10 days.

W. T. H.

Determination of true sodium content of calcium carbonate intended for use in J. Lawrence Smith method. EARLE R. CALEY. *Ind. Eng. Chem., Anal. Ed.* 1, 191-2 (1929). Evap. the soln. of 2 g. material in 6 N HCl to dryness, dissolve in 2-3 cc. of water and mix with 25 cc. of Mg uranyl acetate. Stir mechanically for 45 min., filter, wash with a special liquid, dry at 105° and weigh.

W. T. H.

Determination of strontium and barium in the presence of each other. LÁSZLÓ SZEBELLÉDY. *Magyar Chem. Folyóirat* 35, 77-80, 100-6 (1929).—The pptn. of Ba as BaCrO_4 and the detn. of Sr in the filtrate are described. If the quantity of either element is very small, evap. the nitrate soln. with HBr , dry the bromides at 100° and triturate the dried mass with 10 cc. of hot isobutyl alc. and det. the Sr as sulfate in the ext. Evap. the filtrate again in the HBr and repeat, eventually weighing the residual BaBr_2 after drying at 180° .

S. S. DE FINÁLY

Electroanalytical determination of thallium as thallic oxide. A. JÍLEK AND J. LUKAS. *Collection Czechoslov. Chem. Comm.* 1, 417-28 (1929).—To a soln. contg. not more than 0.25 g. of Tl as TlNO_3 , add 1-2 g. of 40% HF in an unpolished Pt dish, which is to serve as anode. Electrolyze, with a rotating Pt disk as cathode, using a current of 0.2 amp. After about an hr. all the Tl will be deposited but on both electrodes. Add 1 cc. of 30% H_2O_2 to dissolve the Tl from the cathode and electrolyze for another hr. Repeat the addn. of H_2O_2 and electrolyze for another hr., finally testing the electrolyte with KI . Without breaking the circuit, wash the deposit thoroughly with water, dry at 100° and weigh. The deposit contains 84.44% of Tl and corresponds approx. to the formula $\text{Tl}_2\text{O}_3 \cdot \text{HF}$.

W. T. H.

Volumetric determination of tin. H. WOLF AND R. HEILINGÖTTER. *Chem.-Ztg.* 53, 683 (1929).—For the reduction of stannic Sn to the stannous form, use 3 nails, 8-10 cm. long, heat 8 min. for each 0.1 g. of metal present in the soln., prevent atm. oxidation by means of a Contat-Göckel valve contg. NaHCO_3 soln., cool and filter through a filter contg. some *ferrum reductum*. After the reduction the usual iodometric titration is recommended.

W. T. H.

The detection of vanadium and cerium by hydrogen peroxide. JAN LUKAS AND ANT. JÍLEK. *Chem. Listy* 23, 417-9 (1929).—See *C. A.* 23, 2904. FRANK MARESH.

Notes on the rapid determination of zinc in sulfide ores. H. F. BRADLEY. *Chemist-Analyst* 18, No. 5, 7-8(1929).—Some practical hints for carrying out the $K_4Fe(CN)_6$ method are given. W. T. H.

Determination of halogen by the method of O. Gasparini. II. KURT HELLER. *Z. anal. Chem.* 78, 127-30(1929); cf. *C. A.* 23, 2902.—In the app. of G., perchlorates can be reduced to chloride by electrolysis in concd. H_2SO_4 or in a mixt. of H_2SO_4 and HNO_3 . The electrolysis, however, requires considerable time. It was thought that a little Ti salt was necessary but the latest expts. show that this is not true. W. T. H.

Argentometric studies. I. Note on the potentiometric titration of iodides. W. O. TOMÍČEK. *Collection Czechoslov. Chem. Comm.* 1, 443-8(1929).—Numerous titrations have shown that the titration of iodides potentiometrically with Ag soln. gives irregularities near the end point because of the presence of small quantities of Br which are likely to be present in iodides. W. T. H.

Determination of chlorine in calcium hypochlorite. P. ROSSI. *Chim. ind. agr. biol.* 5, 12-21(1929).—To 5 cc. of $Ca(ClO)_2$ soln. add about 1 g. $NaHCO_3$ and starch soln., and titrate with 0.39% KI soln. until a persistent blue color appears. One cc. KI = 1 g. Cl. G. A. BRAVO

Titrimetric determination of polysulfide sulfur. P. SZERERÉNYI. *Z. anal. Chem.* 78, 36-40(1929).—When an alkali polysulfide is boiled with an excess of Na_2SO_3 , the latter is converted into $Na_2S_2O_3$, 1-4 mols. being formed according to the no. of polysulfide atoms present. If, therefore, the original iodometric value of the polysulfide is obtained and then the iodometric value after treatment with Na_2SO_3 , the no. of polysulfide atoms can be detd. if it is remembered that the Na_2S_x has its original value after being converted to Na_2S but the Na_2SO_3 loses value when changed to $Na_2S_2O_3$. The iodometric titration must take place in the presence of excess $NaHCO_3$. Another method consists in boiling the polysulfide with $NaOH$ and H_2O_2 , which serves to convert all of the sulfide and polysulfide to sulfate; the resulting loss in $NaOH$ can serve as a measure of the polysulfide present. Since thiosulfate is also present in most cases the following procedure is suggested: In one portion det. the alky. with N acid, using methyl orange as indicator. In another portion, ppt. the polysulfide and sulfide by treatment with $ZnSO_4$ soln. and titrate thiosulfate in the filtrate. Then, knowing the alky. and the thiosulfate content, add a measured vol. of the polysulfide soln. to a measured vol. of $NaOH$ and 10-20 cc. of 30% H_2O_2 . After the resulting oxidation is finished, wait 10 min., dil. with cold water and titrate again with N acid, using methyl orange as indicator. If, finally, it is desired to know the quantity of S corresponding to the monosulfide stage, it is necessary to make an iodometric detn. without adding any $ZnSO_4$. W. T. H.

Determination of the sulfur content of gases from boiler furnaces. EDMUND TAYLOR and H. F. JOHNSTONE. *Ind. Eng. Chem., Anal. Ed.* 1, 197-9(1929).—An app. and method of sampling gases from boiler furnaces for the detn. of SO_2 and SO_3 are described. The method is designed to reduce the possibility of oxidation of the SO_2 or the condensation of H_2SO_4 before the analysis is made. It consists in removing the SO_3 as a fog of H_2SO_4 by passing the gases through a fine, dry alundum thimble. The SO_2 is then removed by a standard alk. soln. contg. H_2O_2 . A coarse alundum thimble serves here to break up the bubbles. The H_2SO_4 condensed in the first thimble is detd. by titration after washing out the thimble. The SO_2 is detd. by titration of the excess alkali. The app. is simple and compact enough for power plant use. The accuracy is about 95-98%. A water-cooled sampling tube is described for drawing the gases directly from the furnace. H. F. JOHNSTONE

Titrimetric determination of alkali fluorides and of silicic acid. W. SIEGEL. *Z. angew. Chem.* 42, 856-7(1929).—When 6 mols. of alkali fluoride react with SiO_2 and HCl to form a fluosilicate, there is a loss of 4 mols. of HCl , which can be detd. by titrating, with methyl red as indicator. The reaction can also be used for the detn. of SiO_2 . The SiO_2 can be present as sol or as freshly pptd. gel. W. T. H.

Potentiometric titration of ammonia. EDMUND B. R. PRIDEAUX. *J. Soc. Chem. Ind.* 48, 87-8T(1929).—The H_2 electrode is unsuitable for the potentiometric titration of NH_3 solns. but the quinone/quinhydrone electrode can be applied to the back titration of standard acid in which NH_3 has been absorbed. The results obtained agree with those given by methyl red but the potentiometric method gives a better warning of the approach of the end point, any desirable accuracy can be obtained and the method is applicable to dark colored or turbid solns. W. T. H.

Determination of calcium carbide in calcium cyanamide. DRAGUTIN STROHAL. *Archiv. hem. farm.* 3, 118-23(124 German)(1929).—The method depends upon the wetting of 100 g. of $CaCN_2$ with 50 cc. of 50% alc. and 150 cc. of 10% $NaCl$ soln., driving the

C_2H_2 off with a stream of N_2 during a period of 3 hrs., passing the C_2H_2 over hot CuO and absorbing the resulting CO_2 . JAROSLAV KUČERA

Reduction reactions with calcium hydride. I. Rapid determination of sulfur in insoluble sulfates. WM. E. CALDWELL AND FRANCIS C. KRAUSKOPF. *J. Am. Chem. Soc.* 51, 2936-42(1929).—By heating a sulfate with 14-28 times as much CaH_2 it is possible to convert it into sulfide, which can be detd. by the usual iodometric method after expelling H_2S with acid. The method was tested with K_2SO_4 , $BaSO_4$, $SrSO_4$ and $CaSO_4$. W. T. H.

Rapid differentiation between dibasic and tribasic calcium phosphates. A. B. SCHWEIZ. *Apoth.-Ztg.* 67, 110(1929).—(1) To 0.5 g. of each phosphate in a dish add 3 drops of iodococin, mix in 1 cc. H_2O and add 10 drops dil. HCl (10%). The red color on stirring disappears in the dibasic but not in the tribasic salt. (2) To 0.05 g. of each phosphate add 1 cc. H_2O , a few drops of methyl orange, and 0.1 N HCl drop by drop. The dibasic salt requires 60 drops, the tribasic 110-120 drops of acid to the formation of permanent red. S. WALDBOTT

Method for the analysis of lead peroxide. I. A. V. PAMFILOV. *Z. anal. Chem.* 78, 40-52(1929).—The iodometric titration of PbO_2 has been questioned, but if directions such as those given by the U. S. Bur. of Standards are followed, the results are about as good as can be expected. The thiosulfate method, which depends upon the oxidation of thiosulfate by PbO_2 to $Na_2S_4O_6$, gives lower but reproducible results. A convenient method is to dissolve the PbO_2 in a mixt. of 40 cc. satd. $NaOAc$ in 5% $AcOH$ and 10 cc. of 10% KI soln. After 10 min., when the soln. is perfectly clear, add an excess of $Na_2S_2O_3$ and titrate the excess with standard I_2 soln. W. T. H.

Detection and determination of carbon disulfide and sulfur in fluids. A colorimetric method. J. A. PIERCE. *Ind. Eng. Chem., Anal. Ed.* 1, 227-8(1929).—As reagent, dissolve 1 g. $CuSO_4$ crystals in a little water, add 4 cc. of concd. NH_4OH and 3 g. of $NH_2OH.HCl$. Dil. to 50 cc. and mix. Preserve in the dark for not over a week. Dil. the oil to be examd. with pure $CHCl_3$ to reduce its viscosity and increase the d. so that the reagent will float on top. Place 5 cc. of the resulting oil soln. in a test tube, add 2 cc. of reagent, stopper, tilt back and forth a few times without shaking and allow to stand. Oils which have been shaken with pure CS_2 give an immediate formation of an opaque, chocolate-colored aq. soln., which soon clears, and a heavy slimy ppt. of the same color floats at the boundary of the 2 liquid phases. Less than 0.003% CS_2 can be detected. Oils which have been shaken with pure S give a dense, black, lustrous ppt. When both S and CS_2 are present, it is sometimes possible to detect both ppts. W. T. H.

Determination of silica in the presence of fluorspar. W. T. SCHRENK AND W. H. ODE. *Ind. Eng. Chem., Anal. Ed.* 1, 201-2(1929).—Treat 0.5 g. of sample with 15 ml. of 20% $HClO_4$ which has been satd. with H_2BO_3 at 50°. Evap. and fume 4-5 min. Add a little water and repeat the fuming. Dil. to 75 ml., heat and filter. The SiO_2 thus obtained is free from undecompd. CaF_2 . W. T. H.

Studies on the determination of thallium salts by potassium permanganate in a hydrochloric acid medium. ANT. JÍLEK AND JAN LUKAS. *Chem. Listy* 23, 124-9, 155-62(1929); *Collection Czechoslov. Chem. Comm.* 1, 83-94(1929).—In the titrimetric detn. of Tl salts by $KMnO_4$ in an acid (HCl) soln., the oxidation reaction $Tl_2O + O_2 \rightarrow Tl_2O_3$ does not always go to completion. The $TlCl$ is not very sol. in H_2O and hydrolyzes into the brown hydroxide, which gives an indefinite end point. Titration may be accomplished, however, in a large vol. of soln. in the presence of alkali chlorides, which form a double salt with Tl that does not hydrolyze. KCl was found to be the most satisfactory salt although $LiCl$, $RbCl$, $CsCl$ are almost equally good. The procedure is: Evap. the soln. to dryness with 2-g. KCl and concd. HCl , add more HCl and evap. to dryness. Add H_2O and 3-5 cc. satd. SO_2 soln. After letting stand add 3-5 cc. more of the SO_2 soln. and follow with 10 cc. of concd. HCl . Remove the excess SO_2 by boiling. Dil. to 150 cc. and titrate with 0.02 N $KMnO_4$. FRANK MARESH

Detection of carbon monoxide in the air in factory rooms. M. GRODSEVSKII AND A. BUNEYEV. *Ref. Zentr. ges. Hyg.* 16, 420(1928); *Wasser u. Abwasser* 25, 92.—A method for the detection of CO using ammoniacal $CuSO_4$ soln. F. P. GRIFFITHS

The application of differential potentiometric titration to the estimation of weak acids in dilute solution. BEVERLY L. CLARKE AND LELAND A. WOOTEN. *J. Phys. Chem.* 33, 1468-80(1929).—In connection with studies concerning the $AcOH$ content of woods it became necessary to estimate with precision acid concns. corresponding to 0.0004 N for which titrations with ordinary indicators were out of the question. The differential titration method of MacInnes proved more promising but required certain modifications in the method and a new form of app. In this paper the

theory of the method is presented. The electrode system used consisted of 2 bright Pt wires dipping in the soln. of unknown concn. HCl was added to make the soln. conductive. The titrations were conducted in a closed system in an atm. of N_2 or of H_2 , and 0.001 *N* Ba(OH)₂ was used as the titrating agent. On the acid side of the equivalence point, equil. was obtained within about 2 min., but on the alk. side the potentials were rather unsteady and showed a tendency to drift. To stabilize the potentials, the solns. were satd. with quinhydrone. MacInnis found that in the presence of quinhydrone a second max. was obtained in the titration curve, shortly after the first one. M. attributed this to the dissoen. of quinhydrone as a weak acid but Rabinowitsch and Kargin claimed that it was due to CO₂. Under the conditions described in this paper, the second max. did not appear. The marked irregularities on the alk. side are perhaps due to unknown changes taking place in the quinhydrone. W. T. H.

Iodometric determination of phosphorous acid. ALFRED SCHWICKER. *Z. anal. Chem.* 78, 103-9(1929). Methods for the iodometric detn. of H_3PO_3 have suffered from the slowness of the oxidation by means of I_2 . By properly regulating the alk., however, the oxidation can be made to take place within a few min. instead of 2 hrs. Thus, if 30 cc. of 0.1 *N* I_2 soln. is adequate for the oxidation, add dropwise 3 cc. of *N* KOH, after 30 min. make acid with 10 cc. of 2 *N* HCl and titrate the excess I_2 with $Na_2S_2O_3$. With NH_4OH the reaction is complete in 15 min., when 3-4 cc. of *N* NH_4OH is added as above. Still better is the addn. of 5 cc. of *N* $(NH_4)_2BO_3$ made by dissolving 20 g. of H_3BO_3 in 170 cc. of 10% NH_3 soln. Finally, H_3PO_3 can be oxidized satisfactorily by a mixt. of KI and KIO_3 , although 2 hrs. is necessary to complete the oxidation. H_3PO_3 in this respect behaves differently, it causes liberation of I_2 from the mixt. by virtue of its acidity but the liberated I_2 does not oxidize the hypophosphite.

W. T. H.

Determination of anions by methods of drop analysis. A. I. SHEINKMAN. *Farm. Zhur.* 1929, 329-30(In Ukrainian).—Detns. of CN^- , $Fe(CN)_6^{4-}$, $Fe(CN)_6^{3-}$, CNS^- , I^- , Br^- and Cl^- by means of drop analysis are described. J. KUČERA

Iodometric determination of ferrous iron. LÁSZLÓ SZEBELLÉDY. *Magyar Chem. Folyóirat* 35, 122-8(1929). Fe^{++} can be titrated with 0.1 *N* I soln. in the presence of org. matter, if the resulting Fe^{+++} is made to form a complex with fluoride and oxalate or pyrophosphate and oxalate. The titration should be made in a specially closed bottle to prevent atmospheric oxidation. A correction factor of 1.012 should be used because of such oxidation.

S. S. DE FINÁLY

Determination of inert gas content of gas mixtures by means of calcium as absorbent. MARTIN LEATHERMAN AND EDWARD P. BARTLETT. *Ind. Eng. Chem., Anal. Ed.* 1, 223-5(1929).—An app. is described which permits the measurement of inert gas to within 0.01% and depends upon the fact that N_2 , O_2 , H_2O and most other atm. gases, except the inert gases, will combine with hot Ca. The Ca is heated repeatedly by electricity flowing through resistance ribbon until no further diminution in vol. is accomplished thereby.

W. T. H.

Sampling of gas over mercury at a constant rate. S. PEXTON AND W. K. HUTCHINSON. *J. Soc. Chem. Ind.* 48, 242-4T(1929).—A portable app. is described and pictured which provides for the steady collection of a gas sample. The accuracy of the sampling is discussed mathematically.

W. T. H.

Determination of carbon dioxide in gas mixtures when acetylene is also present. H. FRIEDRICH. *Chem.-Ztg.* 53, 706-8(1929).—Details are given for a method which depends upon the absorption of CO₂ by soda lime in one portion of the gas and on the detn. of both CO₂ and C_2H_2 in another sample by treating with fuming H_2SO_4 and subsequently with KOH.

W. T. H.

Determination of total moisture in carbon blacks. C. M. CARSON. *Ind. Eng. Chem., Anal. Ed.* 1, 225(1929); cf. *C. A.* 23, 5351.—Place 5 g. of material, 25-35 cc. of dry xylene and 200 cc. of dry mineral oil in a 500-cc. round-bottomed flask. Heat to 150-175° in an oil bath while passing dry N_2 through the app. Distil into a small distg. flask and thence, by heating in a water bath, into a $CaCl_2$ tube while continuing the stream of N_2 . The quantity of H_2O thus obtained is higher than that obtained by oven drying.

W. T. H.

Titrimetric determination of arsenic in organic and inorganic compounds and in the presence of halogens and heavy metals. PÁL V. VILLECZ. *Magyar Gyógyszerész. Társaság Értesítője* 4, 313-37(1929).—Org. compds. are destroyed by 30% H_2O_2 in the presence of concd. H_2SO_4 . Halides are also oxidized to halogens and removed by strong boiling. The H_3AsO_4 formed is then reduced by boiling with hydrazine sulfate in concd. H_2SO_4 . The excess hydrazine is oxidized by the H_2SO_4 and the SO_2 formed should be

boiled off. The arsenious acid can then be titrated by the KBr_3 method of Györy.

S. S. DE FINÁLY

Chromic acid combustion of organic compounds, especially of nitro and amino compounds. FELIX FRIEDEMANN. *Z. ges. Schiess-Sprengstoffw.* 24, 208-10(1929).—About 0.1 g. of sample is dissolved in pure 95-96% H_2SO_4 in a 300-cc. Erlenmeyer flask with reflux condenser, $K_2Cr_2O_7$ soln. (2 N) added, and the mixt. boiled 20 min., cooled and dild. KI is added and the soln. titrated with $Na_2S_2O_3$. The amts. of H_2SO_4 and $K_2Cr_2O_7$ soln. required vary with the nature of the substance to be oxidized. In general, about 120% of the theoretical amount of $K_2Cr_2O_7$ is used. The H_2SO_4 is increased for the more difficultly combustible substances, e. g., for sugar 2 cc., for TNT 10 cc. for $(C_6H_5)_2NH$ 20 cc. From the results given, the method appears to be accurate within 0.0001 to 0.001 g. A modification of the method for use in the detn. of such highly resistant substances as fats and paraffin is described.

C. G. STORM

Determination of organic peroxides. S. MARKS AND R. S. MORRELL. *Analyst* 54, 503-8(1929).—The object of this investigation was to discover a reliable method for detg. the peroxide-oxygen of oxidized linseed oil and of certain oxidation products of the glyceride of β -eleostearic acid. The following modification of Fabrian's method gave good results: Dissolve 0.2 g. of material in 25 cc. of glacial AcOH, add 2 cc. of cold, concd. KI soln. and allow the mixt. to stand a few min. Dil. with 100 cc. of water and titrate with 0.1 N $Na_2S_2O_3$.

W. T. H.

Determination of sulfur in organic liquids. S. LANDA. *Collection Czechoslov. Chem. Comm.* 1, 397-400(1929).—By mixing 0.15-0.3 g. of the material with 5-15 cc. of an appropriate solvent, such as abs. alc. or EtOAc, the so-called lamp method can be applied to the detn. of S in many substances other than gasoline. The vapors are passed over glowing Pt, the SO_2 is absorbed in H_2O_2 and the resulting H_2SO_4 titrated.

W. T. H.

Determination of traces of acetylene in gases. H. VAN DAM. *Ing. chim.* 17, 75-7(1929).—v. D. uses K_2HgI_4 as absorbent of C_2H_2 and its homologs. This forms a white ppt. The original gas is regenerated by the addn. of H_2SO_4 , which is measured in a suitable app. after removal of CO_2 from the alk. reagent.


P. THOMASSET

Rapid volumetric method for the determination of formic and acetic acids in the presence of one another. P. FUCHS. *Z. anal. Chem.* 78, 125-7(1929).—First titrate the total acid content with N NaOH, using phenolphthalein as indicator. Boil near the end point to remove CO_2 and AcH. To the neutralized soln., add pure NaOAc and a considerable excess of nearly satd. $HgCl_2$ soln. Add water to fill the flask $\frac{3}{4}$ full. The following reaction will take place on heating: $NaCHO_2 + 2HgCl_2 = NaCl + Hg_2Cl_2 + HCl + CO_2$. Heat until a vigorous evolution of CO_2 takes place and finally heat near the boiling point for 15 min. Cool, filter and titrate the acid formed with NaOH, using phenolphthalein as indicator.

W. T. H.

Determination of mercaptans in naphtha. P. BORGSTROM AND E. EMMETT REID. *Ind. Eng. Chem., Anal. Ed.* 1, 186-7(1929).—The method described depends upon the formation of Ag mercaptides by shaking with a measured vol. of standard $AgNO_3$ soln., on the removal of the excess Ag by shaking with an excess of standard NH_4CNS and on the titration of the excess thiocyanate with standard Ag soln., using ferric alum as indicator. The results were good. Mercaptans can be removed by $AgNO_3$ and the residual S detd. by the usual lamp method.

W. T. H.

A new color test for adrenaline. ANTONIETTA ORRÙ. *Ann. chim. applicata* 19, 239-40(1929).—Friketohydroindene hydrate, C_8H_7  $C(OH)_2$ (ninidrine), which was for-

merly (Ruhemann, *C. A.* 5, 1078) considered a special reagent for detecting NH_2 groups of amino acids, will also react with adrenaline, and may be used to distinguish it from pyrocatechin, since this gives most other reactions of adrenaline. 0.1 gm. of the reagent is dissolved in 300 cc. H_2O , and 2 drops of this soln. added to a trace of adrenaline in 1 cc. H_2O , a blue coloration resulting. The reaction is shown only by the free base; the synthetic product also shows this reaction.

A. W. CONTIERI

Reclamation of Ag from residues (Case) 6. The use of a quartz lamp in qualitative analysis (KUBELKA) 2.

8—MINERALOGICAL AND GEOLOGICAL CHEMISTRY

EDGAR T. WHERRY AND J. F. SCHAIER

Structural reasons for oriented intergrowths in some minerals. JOHN W. GRUNER. *Am. Mineral.* **14**, 227-37(1929) — Oriented intergrowths as seen under the metallographic microscope are discussed. It is found that intergrowth takes place only on those crystallographic planes in which the at. agreement and spacing are almost alike. At least one of the chief chem. constituents of the 2 minerals is found in both and there is reason to believe that one of the structural planes is shared by both minerals at the contact. An O or a S layer seems to be the common contact plane in the examples investigated.

A. M. BRANT

The determination of depolarization of the Tyndall beam as a working method in colloid chemistry and mineralogy. BRUNO LANGE AND WILHELM EITEL. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., **57**, 541-62(1928); cf. C. A. **22**, 2504. J. F. S.

The color of minerals. II. The absorption of red colored minerals and artificial preparations in the visible and ultra-violet part of the spectrum. O. WEIGEL AND H. UFER. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., **57**, 397-499(1928). — A continuation of C. A. **23**, 1368. J. F. SCHAIER

New mineral names. W. F. FOSHAG. *Am. Mineral.* **14**, 244(1929); cf. C. A. **23**, 2125. Condensed data are given on *renardite* and *chit-lorocite*. A. M. BRANT

Minerals of the manganese ore deposits in the Zelezné Mts. A preliminary list with chemical analyses by V. Vesely. FRANTIŠEK SLAVIK. *Časopis Národního Muzea (Praha)* **102**, 112-27(1928). *Mineralog. Abstracts* **4**, 74-5. Mn ores mined between Chvalětice and Sobolusky in the Iron Mts. of eastern Bohemia consist of massive Mn-Fe carbonate. This has been partly altered to a mixture of black oxides. The mineral list includes: pyrite, pyrrhotite, arsenopyrite, chalcopyrite, quartz, chalcedony, pseudo-chalcedonite, opal, hematite, goethite, stilpnosiderite, limonite, manganite, hausmannite, psilomelane, wad, calcite, rhodochrosite, siderite, aragonite, gypsum, alunite, alunogen, aluninite, destinezite, cacoxenite, vivianite, vashegyite, garnet, anthophyllite and rhodonite. J. F. SCHAIER

The crystal structure of stibnite. ZIRŌ OOE. *J. Geol. Soc. Tokyo* **33**, 187-204. *Neues Jahrb. Mineral. Geol.* **1928**, I, 61-2. *Chem. Zentr.* **1928**, I, 2774. Photographic, spectrometric and x-ray studies were made on Sb glance crystals from Ichinokawa. The crystals belong to the holohedral class of the rhombic system and show the symmetry of the group $D_{2h} = Vh$. The axial ratios are $a:b:c = 0.99257:1:0.33929$. The cells contain 4 mols. of Sb_2S_3 and have the dimensions $a = 11.16$, $b = 11.25$ and $c = 3.89$ Å. C. R. FELLERS

The slip planes of galena. H. SEIFERT. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., **57**, 665-742(1928) — A math. and crystallographic discussion of the planes of slippage in an isometric crystal. J. F. SCHAIER

A new selenium ore occurrence at St. Andreasberg in the Harz. W. GEILMANN AND H. ROSE. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., **57**, 785-816(1928). Se ores occur in a carbonate gang, Pb, Hg and Se being the principal constituents. Analyses of the ore and gang are given. Clausthalite, tiemannite, guanajuatite, naumannite, umangite, berzelianite, chalcopyrite and danaite are the chief minerals of the ore. By treating clausthalite with $HgCl_2$ at 300° a solid crust of HgSe grew on the mineral: $PbSe + HgCl_2 \xrightarrow{300^\circ} HgSe + PbCl_2$. This reaction explains the presence of *tiemannite*. J. F. SCHAIER

Klochmannite, a new natural copper selenide. PAUL RAMDOHR. *Centr. Mineral. Geol.*, A, **1928**, 225-32; *Mineralog. Abstracts* **4**, 14. A new mineral, *klochmannite*, occurs with *umangite* at Sierra de Umango, Argentina and in Sweden. Analyses gave (after deducting about 50% impurities) Cu_2Se for *umangite* and $CuSe$ for *klochmannite*. The latter shows basal cleavage, and is perhaps hexagonal and isomorphous with covellite. J. F. SCHAIER

The minerals of Rüdersdorf near Berlin. KARL SCHULZ. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., **57**, 743-62(1928). — Analyses of *sphalerite* and a ferrous-ferric hydrated sulfate are given. J. F. SCHAIER

Cinnabar from Idria. F. RODOLICO. *Atti accad. Lincei* [6], **9**, 176-9(1929). Crystallographic data are given. A. W. CONTIERI

Millerite and associated minerals in the coal measures of south Wales. F. J. NORTH AND W. E. HOWARTH. *Proc. South Wales Inst. Engineers* **44**, 325-48(1928); *Mineralog. Abstracts* **4**, 84. — Millerite, NiS , occurs in 15 localities near Merthyr Tydfil. J. F. SCHAIER

The appearance and properties of a former FeS₂ gel, especially in metasomatic lead-zinc deposits. H. EHRENBURG. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 1303-20 (1928).—A description of the mode of occurrence of pyrite, presumably deposited as a gel. Analyses of the *pyrite* are given. J. F. SCHAIER

Micrography of tetrahedrite and the microscopic distinction from bournonite. WALTER FACKERT. *Metallwirtschaft* 7, 958 (1928).—Tetrahedrite and bournonite are difficult to distinguish from each other in polished section. F. uses a soln. of 4 cc. HNO₃ (sp. gr. 1.2), 9 cc. HCl (sp. gr. 1.19) and 5 to 12 cc. 96% EtOH to etch polished sections. After etching the 2 minerals are readily distinguished—tetrahedrite stands out as distinct isometric crystals, while bournonite is jagged and intergrown. J. F. SCHAIER

Twinning of periclase. H. SEIFERT. *Centr. Mineral. Geol.*, A, 1926, 305-7; *Mineralog. Abstracts* 4, 88.—Crystallographic J. F. SCHAIER

An artificial gem stone isomorphous with spinel. PAUL F. KERR. *Am. Mineral.* 14, 259-64 (1929).—Synthetic gem stones whose optical and phys. properties agree closely with those of spinel are described. The at. spacing is $2d_{100} = 4.00$ A. U. instead of 4.02 as in spinel. The analyses show MgO much too low, however, and Al₂O₃ correspondingly high, to represent spinel (MgO.Al₂O₃), indicating that the material is a synthetic isomorph of this mineral. The analytical results indicate the formula MgO.3Al₂O₃. A. M. BRANT

Crystal structure of chromite. LÁSZLÓ TOKODY. *Math. Természettud. Értesítő* Budapest 45, 278-86 (Hung.), 287-9 (German) (1928); *Mineralog. Abstracts* 4, 29; cf. C. 1 22, 2903. J. F. SCHAIER

Occurrence of rutile in the siderite veins of Rožnava, Slovakia and its position in the vein paragenesis. FRANTIŠEK ULRICH. *Rozprawy České Akad.*, Cl. 2, 37, No. 18, 15 pp (1928), *Mineralog. Abstracts* 4, 74.—Rutile is found with albite in a vein cavity. The wall rock is an aplite composed of albite, quartz, tourmaline, apatite, rutile and siderite. The aplite intrusions are younger than the siderite veins and are closely associated with sulfide ores. J. F. SCHAIER

Polysynthetic twinning in dolomite. AUSTIN F. ROGERS. *Am. Mineral.* 14, 245-50 (1929). Polysynthetic twinning of dolomite in metamorphic rocks is of petrographic and mineralogical importance, the twinning lamellas furnishing a *method of distinguishing dolomite from calcite*. The twinning is parallel to (0221) and occasionally results in a parting. Dolomites from various localities are described and illustrated. A. M. B.

Pyroxenes from eruptive rocks in the neighborhood of Lomnice on the Popelkou. JAROSLAV GOTTHARD. *Časopis Národního Musea* (Praha) 102, 65-71 (1928); *Mineralog. Abstracts* 4, 38-9. The melaphyres of the Permian formation contain typical hypersthene, clinohypersthene, an optically uniaxial monoclinic pyroxene (probably diopside-hypersthene) and another monoclinic pyroxene (probably hypersthene-augite). J. F. SCHAIER

Constitution of augite from the Red Mountains (Aetna). G. GRASSI CRISTALDI AND G. COLUMBA. *Ann. chim. applicata* 19, 173-82 (1929). Augite from the Aetna region consists of diopside-hedenbergite ($R''SiO_3$) 89.93, spinels ($R''R_2'''O_4$) 5.42 and pseudo-jadeite ($R''R_2'''(SiO_3)_4$) 4.65%. A. W. CONTIERI

Wöhlerite and hiortdahlite from Vesuvius. ESPER S. LARSEN. *Festschrift Victor Goldschmidt* (Heidelberg) 172-4, 1928; *Mineralog. Abstracts* 4, 89.—Specimens from Vesuvius labeled "guarinite" show 2 yellow minerals differing in optical properties. The better crystals are identified as wöhlerite, poorly crystd. material in the matrix as hiortdahlite. J. F. SCHAIER

The crystallization of basalts. CLARENCE N. FENNER. *Am. J. Sci.* 18, 225-53 (1929). H. C. PARISH

Studies of simple and twinned crystals of a basaltic hornblende. EGON HARRISCH. *Mineralog. petrog. Mitt.* 39, 204 (1928); *Mineralog. Abstracts* 4, 87.—Crystallographic. J. F. SCHAIER

Huge beryl crystals at Albany, Maine. E. K. GEDNEY AND H. BERMAN. *Rocks and Minerals* 4, No. 3, 78-80 (1929).—Notes on a beryl deposit discovered in Bumpus feldspar quarry on Cummings farm, near Bethel. E. I. S.

The coloring pigment of emerald. A. FERSMAN. *Compt. rend. acad. sci. U. R. S. S.* 1926, 24-5; *Mineralog. Abstracts* 4, 72-3.—Two estms. by K. Nenadkevich of the Cr content of emeralds from the Urals gave 0.11 and 0.19% for a pale crystal and one of medium depth of color, resp. Traces of V were detected spectroscopically in deep colored specimens. Serpentine associated with the emerald contains 0.23% Cr₂O₃. J. F. S.

A monticellite-nepheline basalt from Tasmania: a correction to mineral data. C. E. TILLEY. *Geol. Mag.* 65, 29-30 (1928).—F. P. Paul described a rock from Shannon.

Tier, Tasmania (cf. C. A. 1, 30) contg. an unknown mineral referred by him to Ca_2SiO_4 . Bowen (C. A. 16, 1059) pointed out the close correspondence in optical properties of Paul's mineral with artificial $\beta\text{-Ca}_2\text{SiO}_4$. Later T. applied the name shannonite to this mineral (C. A. 21, 3860). Now that good material is available, the rock is found to consist of approx. 27 nephelite, 27 augite, 27 monticellite and 14% chrysolite. The mineral in the Tasmanian rock was monticellite and not Ca_2SiO_4 , and the name shannonite is withdrawn. J. F. SCHAIRES

Larnite (calcium orthosilicate, a new mineral) and its associated minerals from the limestone contact-zone of Scawt Hill, Co. Antrim. C. E. TILLEY. *Mineralog. Mag.* 22, 77-86(1929); cf. preceding abstract.—The chief minerals of the contact zone apart from calcite are spurrite, larnite (Ca orthosilicate), melilite, (gehlenite), merwinite, spinel, perovskite and wollastonite. The larnite-rich rocks are grayish and close textured. The larnite forms grains showing one good and one imperfect cleavage at 90° . The characteristic feature is exceedingly fine polysynthetic twinning parallel to the prominent cleavage; less commonly a second set of twin-lamellae is developed at 90° to the first. The mineral is monoclinic, optically + with a moderately large optic axial angle; $\alpha = 1.707$, $\beta 1.715$, $\gamma = 1.73$, $\gamma - \alpha = 0.023$, $\gamma - \beta$ and $\alpha \wedge c = 13-14^\circ$. Larnite resembles the artificial α form of calcium orthosilicate. Instability of the mineral was indicated by dusting during the prepn of thin sections, on heating to dull redness, or by the shock of striking the rock with a hammer. The dusted powder corresponds optically with the γ form of the orthosilicate. A. M. BRANT

Mineralogical observations in Chile. W. WETZEL. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 921-44(1928).—A new occurrence of *dumortierite* is described. J. F. SCHAIRES

The paper of P. Stamm on the light absorption and the interference of x-rays in tourmaline. F. RINNE. *Centr. Mineral. Geol.*, A, 1927, 217-8; *Mineralog. Abstracts* 4, 58; cf. C. A. 22, 4350.—R. exposed a tourmaline crystal to radiation from Ra for 40 days, and obtained a complete Laue picture (with a W anticathode). J. F. SCHAIRES

Inesite from Nagybánya. JOSEF KRENNER. *Math. Természettud. Értesítő* (Budapest) 45, 10-1(1928); *Mineralog. Abstracts* 4, 81.—Inesite occurs in quartz as pale-rose globules with radially fibrous structure. J. F. SCHAIRES

The action of various zeolites. G. GRASSI-CRISTALDI AND F. SCAFILE. *Ann. chim. applicata* 19, 136-40(1929).—The 2 zeolites, analcite and mesolite, besides being sol. in mineral acids dissolve in various org acids with decompn. In 5% (COOH)₂ the former dissolves when warm, the latter when cold, thus permitting complete chem. analysis; results for one specimen of each mineral are given. A. W. CONTIERI

Zeolites and associated minerals from the tertiary lavas about Ben More, Mull. M. LINTOCK. *Trans. Roy. Soc. Edinburgh* 51, 1-33; *Chem. Zentr.* 1928, I, 2073.—A description with analyses of several Scottish zeolites. C. R. FELLERS

A rosy muscovite from Suizawa and a dark gray muscovite from Doi. S. IIMORI AND J. YOSHIMURA. *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) 10, 221-3(1929).—An analysis of a pink muscovite is given. The authors suggest that the color may be due to Cu in colloidal form. An analysis of an ordinary muscovite from the Doi district is also given. J. F. SCHAIRES

The spectral differentiation of the pleochroism of biotite. F. RINNE AND S. RÖSCH. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 823-40(1928).—Optical. J. F. SCHAIRES

The prochlorite from Monte Rosso di Verra. T. CARPANESE. *Atti accad. Lincei* 9, 77-83(1929).—Prochlorite from this source when heated loses water gradually except at $500-525^\circ$ and $700-770^\circ$ where considerable is lost; the curves of dehydration are shown, as well as the analysis. Prochlorite loses most of its H_2O of hydration at $550-610^\circ$. A. W. CONTIERI

Röntgenographic studies of varieties of asbestos from different mines. G. I. CLARK AND S. L. VAN ORDEN. *Kautschuk* 5, 28-35(1929).—Chrysotile asbestos (7 samples), amphibole (3 samples), crocidolite and anosite were examd. by x-rays in the fresh condition, after heating to 900° and after heating with concd. HCl. In the acid treatment, the chrysotiles lost more than 50% in wt., and x-rays showed a complete disappearance of the fibrous structure. The other samples showed smaller losses in wt. and they retained part of their fibrous character. On heat treatment the chrysotiles suffered high losses in wt., but in some cases their structures were less affected than those of certain of the amphiboles. It was possible to distinguish among all the samples by the extent to which they differed in behavior. B. C. A.

Asbestos from Dobšiná. OTAKAR KALLAUNER. *Rept. State Res. Inst. Silicate Chem.* (Brno) 1928, 269-74; *Mineralog. Abstracts* 4, 75.—A technical account of the properties of chrysotile-asbestos from Slovakia. Analysis gave: SiO_2 41.25, Al_2O_3 2.94,

Fe_2O_3 2.73 (= FeO 2.46), MgO 39.54, H_2O 13.32 = 99.78 [99.51]%. Digested in HCl (sp. gr. 1.025) the fiber leaves a residue of 46%, and in 5% soda soln. 97.3% is insol.

J. F. SCHAIRER

An occurrence of allophane at Tikak, Assam. A. L. COULSON. *Rec. Geol. Survey India* 61, 363-6(1929).—The mineral occurs as streaks and pockets in a 20-ft. coal seam. It is amorphous, isotropic (n_x^{20} 1.489), brittle, orange-yellow in color, shows a conchoidal fracture and has sp. gr. = 2. Two analyses show a mol. ratio for $\text{Al}_2\text{O}_3:\text{SiO}_2:\text{H}_2\text{O}$ of 1 2:1:6.3 and 1.1:1:6.5.

ALDEN H. EMERY

Hydroboracite from California. WALDEMAR T. SCHALLER. *Festschrift Victor Goldschmidt* (Heidelberg) 256-62(1928); *Mineralog. Abstracts* 3, 93-4.—Hydroboracite occurs as radiating fibrous or columnar masses on colemanite near Ryan, Inyo Co., Cal. Opt. data are given. Analysis gave: B_2O_3 47.71, CaO 14.06, MgO 10.14, Fe_2O_3 0.12, SiO_2 0.23, H_2O 27.37 = 99.63, agreeing with the usual formula $\text{CaO} \cdot \text{MgO} \cdot 3\text{B}_2\text{O}_3 \cdot 6\text{H}_2\text{O}$.

J. F. SCHAIRER

Base exchange in artificial autunites. J. G. FAIRCHILD. *Am. Mineral.* 14, 265-75 (1929).—Artificial autunites were made by slow crystn. from dil. solns. and by a "salting out" process, with a chloride as the pptg. agent. Ca, K, Ba, Mn, Cu, Co, Ni, Pb and Mg autunites were prepd. by treating Na autunite, and in some cases Ca autunite, with a strong soln. of the chloride of the desired element. The change from Na autunite to Ca autunite and the reverse can apparently be repeated alternately as often as desired. Most of the autunites contained less than 8 mols. of water.

A. M. BRANT

The certain detection of genuine Baltic amber from substitutions or falsifications with special reference to an optical differentiation-method. C. PLONAIT. *Mitt. Abt. Gesteins, etc.; Unters. preuss. geol. Landesanstalt* 2, 30-74; *Chem. Zentr.* 1928, I, 2874—Optical methods are described in which amber is differentiated from artificial phenolic resins, copal, etc. Phys. constns. are given.

C. R. FELLERS

Ore genesis and oreshoots. CARLTON D. HULIN. *Eng. Mining J.* 128, 228-30, 317, 20(1929).—Mineralization generally does not occur until after the injection of the acid and basic satellitic dikes. The relative affinities of the several elements for the acid and basic differentiates, resp., are grouped into: (1) those that characterize extreme acid differentiates, and (2) those that characterize basic magma. It is believed that hydrothermal and emanation types of ore deposits have resulted from the combined action of 2 sets of solns.: a soln. derived from the acid differentiate and carrying largely elements of (1), and a soln. derived from a basic differentiate carrying largely elements of (2). A theory is advanced to explain the occurrence of both ore shoots and barren veins. The veins are formed during the early stages of mineralization, being deposited in existing fissures by the silica-bearing solns., while ore shoots are produced during the latter part of the period wherever openings still exist through which the metallizing solns. may pass and deposit their load. Theories accounting for the mode of vein formation are limited to the following: (1) by filling of an open fissure; (2) by replacement; (3) by the force of crystn. of the vein minerals; (4) by the hydrostatic pressure of the vein depositing solns., and (5) by injection of a viscous ore magma. The formation of ore shoots is discussed, also 8 structures favorable to their formation.

W. H. B.

General report for 1928. EDWIN PASCOR. *Rec. Geol. Survey India* 62, 1-184 (1929).—New occurrences of the following economic products are reported and described: asbestos, barite, building stone, chromite, clay, coal, Cu, dolomite, gas, glass sand, Au, graphite, Fe, jadeite, Pb, limestone, Mn, ocher, oil shale, petroleum, Pt, pyrite, salt, sand and Sn. Water resources are discussed. A year's bibliography of publications on Indian minerals is given.

ALDEN H. EMERY

Characteristic features of the ore deposits of Japan, related genetically to the late Tertiary volcanic activity. TAKEO KATO. *Japan. J. Geol. Geography* 6, 31-48(1928).—Ore deposits, connected genetically with igneous activity, except the liquid magmatic or magmatic segregation types, were formed by mineralizing solns., ranging from pegmatitic pneumatolytic to hydrothermal. These solns. represent late stages in magmatic solidification in deep zones. Volcanic deposits, due to exhalations from rocks solidifying at or near the surface, must be insignificant from an economic viewpoint. Overlapping and successive mineralization are due to the comparative shallowness of the parent magma and to rapid cooling of the expelled residual solns. within a limited depth zone.

J. F. SCHAIRER

Geology of the country around the Lonely Mine, Bubi district. A. M. MACQUEGOR. Southern Rhodesia Geol. Survey, *Bull.* No. 11, 96 pp.(1928); *Mineralog. Abstracts* 4, 89.—A geological description of an ore body. The ore-bearing reef has been followed more than 1000 ft. along the strike. The av. yield of Au is about 26 pennyweights per ton.

J. F. SCHAIRER

Gold found near Vodňany. BOHUSLAV JEŽEK. *Báňský Svět* (Praha) **6**, 49-54 (1927); *Mineralog. Abstracts* **4**, 82.—A loose block of quartz found in 1927 contains Au (electrum with 53% Au). Cf. following abstr. J. F. SCHAIER

Gold found near Křepice, south of Vodňany. FRANTIŠEK SLAVÍK. *Věda Pěstovní* (Praha) **8**, 218(1927); *Mineralog. Abstracts* **4**, 82.—The fact that the cryst. structure of the flakes is impressed on the quartz suggests that there was a later deposition of colloidal SiO₂ during cementation. Cf. preceding abstr. J. F. SCHAIER

Geochemistry of lead and the lead deposits of the world. H. SCHNEIDERHÖHN. *Metallwirtschaft* **7**, 191-6(1928).—The mode of occurrence and geological relations of Pb ore are briefly outlined. Pb usually occurs along with Zn. Because of similar at. vols. Fe, Mn and Cd occur isomorphous with Zn. Since there are no elements except the alk. earths that have an at. vol. similar to Pb, galena, PbS, usually lacks accessory elements. When argentiferous galena is found the Ag is not isomorphous with Pb but present as a sep. mineral. The occurrence of large deposits of anglesite and cerussite is conditioned by the ease of oxidation of PbS and the insol. of PbSO₄ and PbCO₃. J. F. SCHAIER

The origin of the zinc deposits at Franklin and Sterling Hill, New Jersey. W. A. TARR. *Am. Mineral.* **14**, 207-21(1929).—The original ore-body is thought to have consisted of sphalerite, pyrite or marcasite, calcite and rhodochrosite deposited near the surface in the Franklin limestone by solus. from an unknown source. The next step was the oxidation of the ore-body, yielding in the order of abundance Fe and Mn oxides (anhydrous and hydrous), hemimorphite, smithsonite and rhodochrosite. The tabular shape of the present ore-bodies is assumed to be similar to the original bodies, the curved or hook-shape being due to subsequent folding. The absence of Al compds. indicates that the original deposits were wholly within the limestone and not residual masses on the surface. The conversion of the oxidized minerals into the anhydrous silicates and oxides of the present deposit was brought about by intense metamorphism. All the minerals in the original rock have been recrystd. The practical absence of Fe⁺⁺ is strong proof of the theory that a fully oxidized ore-body was the source of the present ores. The willemite, tephroite, franklinite and zincite were formed by dehydration and interaction of the minerals in the oxidized ore body, the reactions being dominantly temp. effects and attendant recrystn. Isomorphism played a strong part in the formation of the present ores. A. M. BRANT

New chromite localities. A. L. COULSON. *Rec. Geol. Survey India* **62**, 185(1929).—Two new Indian occurrences are located. ALDEN H. EMERY

Interim report on the geology of the chromite deposits of the Umvukwe range, Lomagundi district. F. E. KEEP. Southern Rhodesia Geol. Survey, *Short Report No.* **23**, 10 pp.(1928); *Mineralog. Abstracts* **4**, 80. Cr deposits occur in thin seams in serpentinized enstatite rock. About 52% Cr₂O₃ is present and at least 200,000 tons of chromite can be produced for every 100 ft. of incline depth, from each 2 3/4 sq. miles of country. J. F. SCHAIER

Geology and water resources of the Edgeley and La Moure Quadrangles, North Dakota. HERBERT A. HARD. U. S. Geol. Survey, *Bull.* **801**, 87 pp.(1929).—Building materials—sand, gravel and glacial boulders—are plentiful in the Edgeley-La Moure area, while the clay and shale might be of possible value. In some sections an alk. soil ("gumbo") occurs, which contains a large amt. of Na₂CO₃ and CaSO₄. Two small deposits of peat were noted. There are many artesian wells, most of the water, which is strongly mineralized, being supplied by the Dakota sandstone. Water from the 1st horizon has a salty taste due to its high NaCl content, but may be used for most purposes. That of the 2nd and 3rd sandstone horizon is valueless for drinking and boiler use because its mineral content is too high. The mineral content of water from the shallow wells is also very high. Analyses are given for these waters. The temp. of the artesian water is 50-70°F. Small quantities of natural gas are released from the artesian water, mainly CH₄; the yields have become too small to warrant operating expenses. G. S.

Geography, geology and mineral resources of the Portneuf Quadrangle, Idaho. GEORGE ROGERS MANSFIELD. U. S. Geol. Survey, *Bull.* **803**, 107 pp.(1929); cf. *Professional Paper* **152**.—"The mineral resources of the quadrangle are phosphate rock, which is the most valuable, limestone, road metal, building stone and quartzite. Phosphate is discussed both in connection with the description of 7 individual townships and in some of its broader relations. All these resources are present in sufficient quantity to supply more than any probable local need over a long period. Water resources are described in the final chapter. Surface waters are insufficient for irrigation within the quadrangle, because under the present plan of utilization much of the available supply is distributed outside. Ground water is apparently abundant, but as yet is little utilized. The opportunities for power development within the quadrangle are not promising."

Analyses of the phosphate rock showed variations in the P_2O_5 content of 18.21–35.46%. Fe_2O_3 was 1.04% and Al_2O_3 was 3.04% in 1 composite of 2 samples; another composite contained 1.48% Fe_2O_3 + Al_2O_3 . The phosphate contains V: in 3 samples 0.17, 0.4 and 0.5% V_2O_5 were found. G. SCHWOCH

Dolomite, its properties and applications, with special reference to the manufacture of dolomite cements. JAROSLAV ŠIMANĚ. *Rept. State Res. Inst. Silicate Ind. (Brno) 1928*, 73–222; *Mineralog. Abstracts* 4, 75.—A detailed account of the physico-chem. and technological properties and natural occurrences of dolomite. Results are given of numerous expts. on the thermal dissocn. of dolomite and magnesite, and on the properties of the resulting oxides. J. F. SCHAIRER

Feldspar deposit near Pisek. JOSEF V. ŽELIZKO. *Věstník Státního Geol. Ústavu Československé Republiky* 4, 23 30(1928); *Mineralog. Abstracts* 4, 76.—An analysis of feldspar is given. J. F. SCHAIRER

Basic industrial minerals. VII. Leucite. G. MALCOLM DYSON. *Chem. Age (London)* 20, 472 3. **VIII. Ultramarine.** *Ibid* 21, 255–6(1929); cf. *C. A.* 23, 3055. E. J. C.

Nephelite. N. I. VLODAVETZ. *Z. prakt. Geol.* 37, 10 3(1929); *Mineralog. Abstracts* 4, 78.—Nephelite sand occurs in large quantities on the shores of Lake Imandra, Kola Peninsula, close to a railway. Trials have been made on using it instead of Na_2SO_4 in making bottle-glass. Chem. analyses are quoted and references given to the Russian literature. J. F. SCHAIRER

"Bauxite" from Kashmir. T. V. M. RAO. *Mineralog. Mag.* 22, 87–91(1929); cf. *C. A.* 22, 2125. The deposit in the form of a bed of 7–10 ft. thick is composed of a mixt. of a small amt. of diaspore and abundant boehmite with a few accessory minerals. Analyses of typical specimens are given. A. M. BRANT

Occurrence of bentonite in southern Arkansas. GEORGE C. BRANNER. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 239*, 11 pp.(1929).—The occurrence of 3 bentonite deposits in similar stratigraphic positions suggests large quantities in a zone along a line connecting the Saline, Hot Spring and Ouachita County deposits with those northeast. The material is accessible and easily mined. E. M. SYMMES

Ball clays. ALEX. SCOTT. *Dept. Sci. Ind. Research, Geol. Survey Great Britain* 31, 68 pp (1929); cf. *C. A.* 23, 3642. The origin, occurrence, mineralogy, chem., phys. and utilization of the ball clays of southwest England are discussed. K. D. JACOB

Colored clays of the Olonetz region. U. S. S. R. I. LILEEV. *Trans. State Inst. Applied Chem. (Moscow)* No. 8, 74 98(1927). The resources of the Olonetz region in colored clays suitable for the manuf. of mineral earthy paints are thoroughly examd. Mineralogical and geological descriptions are given, as well as a compn. table, diagrams, a map and a colored plate. As a rule, these clays contain much silica which interferes with their covering capacity, and their value depends on their Fe_2O_3 contents. Up to now these paints have been mfd. by primitive means and without SiO_2 elimination. The colors are usually various shades of red and pink. BERNARD NELSON

Observations on the colloid chemistry of the color problem of motley colored clays. GEORGE GOGUEL. *Kolloid-Z.* 48, 305 18(1929). Variegated potters clay, as well as other motley colored clays, marls and slates, etc., is found in almost all geological formations. They are primarily of marine origin, the peculiar arrangement having resulted from alternate elevation and sinking and from pressure. No satisfactory explanation has been made for the coloring of these clays. Tests were accordingly made as to the absorptive properties of clays and the process of rhythmic pptn. Since Fe is one of the most important constituents of the coloring matter in rocks, artificial Fe sulfide colloids were prepared. It was found that a permanent green color cannot be due to this substance because of its unstable character. Artificial colors were produced in silica gels by varying the ratio of Fe^{+++} to Fe^{++} in regular steps and then pptg. the oxides, and compared with the natural colors, by using color filters and a polarizing photometer. The results obtained indicated that the coloring agents were colloidal. Complete analyses of ten variegated potters clays (4 red, 4 green, 2 blue) showed clearly that the coloring is not entirely due to the absolute Fe^{+++} , Fe^{++} , Ti or V content, but depends even more on the colloid nature of the color carriers. The analyses also showed that for green clays, a lower $MgCO_3$ content and a higher C content were characteristic, and for red clays the reverse. The phys., photometrical and chem. measurements reported all indicate that the coloring of red and yellow-red clays is due to the presence of 95–100% oxide-colloids and that of the green and violet clays to colloidal mixed systems containing Fe in different valence states. L. L. Q.

Red and green colors of clays and clay-bearing sediments. H. STREMMER. *Neues*

Jahrb. Mineral. Geol., A, Beil.-Bd., 57, 895-920(1928).—The color of clays and clay-bearing sediments is a function of the ratio of Fe_2O_3 to FeO . Those sediments with a high ratio have the red color. J. F. SCHAIRES

Pigment minerals of South Australia. R. LOCKHART JACK. *Bull. Geol. Survey S. Australia* No. 13, 70 pp.(1928); *Mineralog. Abstracts* 4, 77.—Barite, talc, ocher, ilmenite, clay, gypsum, Cu carbonates, graphite and MnO_2 are mined for pigments. Several chem. analyses of raw materials are given. Light yellow *carphosiderite* (analysis given) is available in large amts. This mineral is roasted for the prepn. of red oxide. J. F. SCHAIRES

Surveys in Northwestern Alaska in 1926. PHILIP S. SMITH. U. S. Geol. Survey, *Bull.* 797-D, 125-42(1929); cf. *C. A.* 22, 1305.—It is improbable that com. quantities of oil will be found in the Brooks Range, Northwestern Alaska. North of this range is a plateau region where the chances of finding com. oil are more promising. The petroleum from the seepages examd. was a light oil, in which gasoline and other highly volatile constituents were absent. It had a naphthalene base and its sp. gr. was 0.943. Vast quantities of coal, which is mainly of the sub-bituminous type, occur north of the Brooks Range. Since the local coal consumption is very small, it is improbable that the coal fields will be developed in the near future. Au, Cu and Pb ores were found in the mountains, but the present economic conditions do not favor their development. G. SCHWOCH

Geology and mineral resources of the Aniakchak District, Alaska. RUSSELL S. KNAPPEN. U. S. Geol. Survey, *Bull.* 797-F, 161-223(1929); cf. Smith and Baker, *C. A.* 19, 1839.—The chances of finding oil in the Aniakchak District are not promising. Coal occurs in the Eocene beds and in the Chignik formation, but only in the latter is it of probable com. significance. The small mines are abandoned at present. No metallic minerals of economic importance were found. G. SCHWOCH

Note on the Joya Mair Dome Fold, near Chakwal, Jhelum District, Punjab. D. N. WADIA. *Rec. Geol. Survey India* 61, 358-62(1929). The lithology and structure of a dome favorably situated as an oil reservoir are described. ALDEN H. EMERY

The mining of gilsonite in Utah. W. J. FENE. *Rocks and Minerals* 4, No. 3, 86-90 (1929).—The description of a mine explosion and a discussion of the origin of Utah gilsonite are of chem. interest. E. I. S.

Geology and water resources of the upper McKenzie Valley, Oregon. HAROLD T. STEARNS. U. S. Geol. Survey, *Water-Supply Paper* 597-D, 171-88(1929). G. S.

The graphic treatment of quaternary systems. H. v. PHILIPSBORN. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 973-1012(1928); cf. *C. A.* 23, 1342.—P. projects quaternary points and curves inside of a tetrahedron on the 4 faces of the tetrahedron. The method provides for the plotting of wet residues in systems with water as one component. The method may be applied to advantage in petrographic studies. J. F. S.

The hardness and strength of rocks. G. ELSTER. *Glückauf* 64, 278-81(1928).—Tables are given to show the relation of hardness to SiO_2 content to 16 common rocks. J. F. SCHAIRES

Orbicular granites, spotted and nodular granites, etc., and the Rapakivi texture. J. J. SEDERHOLM. *Bull. comm. géol. Finlande* No. 83, 105 pp.(1928).—After describing in detail 5 new occurrences of orbicular granites in Finland, S. discusses at length the theoretical conclusions concerning the origin of such rocks. The hypothesis of limited immiscibility to explain the spheroids is rejected as incompatible with the known facts of silicate chemistry and the data on their chem. compn. Definite proof is given of the exotropic character of the spheroids. Viscosity is an important factor conditioning the size of the grain in igneous rocks. There is a causal connection between the occurrence of ovoidal feldspar and oligoclase rims and the former is due to the high viscosity of the oligoclase-rich magma surrounding the feldspars during growth. An ultrabasic residual magma has been occasionally formed through fractionation toward the end of the crystn. This paper represents a critical and comprehensive study of the textures of certain igneous rocks and a discussion of the phys. and chem. factors which produce or modify rock textures. Analyses of orbicular granites, spheroids from them, the cementing mass between spheroids and biotite from these rocks are included. J. F. S.

Genetic relation and chemistry of the rocks of the Bushveld igneous complex, Transvaal, and the problem of its origin. R. REUNING. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 631-64(1928). J. F. SCHAIRES

The eruptive rocks of the Mátragebirges, Hungary. B. MAURITZ. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 331-96(1928).—Analyses are given of microfelitic rhyolite, rhyolite-perlite, spherulitic-glassy rhyolite, tuff, pyroxene-andesite and other rocks. J. F. SCHAIRES

Keweenaw sill rocks of Sudbury and Cobalt, Ontario. T. C. PHEMISTER. *Trans. Roy. Soc. Can.* [3], 22, Sect. 4, 121-97(1928).—The mineralogy and petrography of the quartz diabase intrusions of Keweenaw age occurring in these mining areas are described and compared in detail. Analyses of the rocks are given, and their classification and origin outlined.

A contribution to the petrology of the Whin Sill. S. I. TOMKIEFF. *Mineralog. Mag.* 22, 100-20(1929); cf. Holmes and Harwood, *C. A.* 23, 66.—A petrographical description of the fine-, medium- and coarse-grained types of rock forming the sill and the exceptional varieties, red acid segregations, spheroidal aplitic inclusions and pectolite inclusions.

A diabase contact rock. L. MILCH. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 841-94(1928).—Several rock analyses are included.

Composition of the phonolite from Heldburg near Koburg. H. JUNG. *Chem. Erde* 4, 23-6(1928).—A detailed chem. analysis of this rock differs appreciably from that of Hilger (1890).

The peridotite from Kaersut, Greenland, and its gang minerals as an example of secretion differentiation. F. K. DRESCHER AND H. K. F. KRUEGER. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 569-616(1928).—Analyses of pyroxene, peridotite and zeolites are given. The chem. changes during differentiation are presented by diagrams and analyses.

Petrographic studies of inclusions and contact rocks from the Harzburger gabbros. GEORG FIEBOLD. *Neues Jahrb. Mineral. Geol.*, A, Beil.-Bd., 57, 287-330(1928).—Petrographic. An analysis of quartz-cordierite hornfels is included. It is suggested that in certain metamorphic processes cordierite changes to muscovite according to the equation: $3(2\text{MgO} \cdot 2\text{Al}_2\text{O}_3 \cdot 5\text{SiO}_2) + 2\text{K}_2\text{O} + 4\text{H}_2\text{O} = 2(\text{K}_2\text{O} \cdot 3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 2\text{H}_2\text{O}) + 6\text{MgO} + 3\text{SO}_2$.

Hamrongite, a new Swedish alkaline mica lamprophyre. HARRY VON ECKERMANN. *Fennia, Bull. Soc. geogr. Finlande* 50, No. 13, 21 pp.(1928); *Mineralog. Abstracts* 4, 44.—A dike rock traversing brecciated granite-gneiss is named hamrongite. It is a quartz-kersantite containing quartz and calcite both in the ground-mass and in vesicles with andesine, orthoclase, porphyritic biotite and cordierite pseudomorphs. Chem. analyses are given in the original.

A garnet-bearing dike near Mornya, New South Wales. IDA A. BROWN. *Proc. Linnæan Soc. N. S. Wales* 54, Pt. 3, 176-84(1929).—B. describes a basaltic dike contg. fragments of basic and ultra-basic rocks, particularly pleo-naste-bearing pyroxenites and large xenocrysts of red-garnet, brown hornblende, augite and basic plagioclase, which probably constituted a coarsely cryst. garnet-bearing eucrite. The inclusions are truly xenolithic in origin and not comagmatic with the basalt.

Occurrence of dark apatite in some British rocks. W. F. FLEET AND F. SMITHSON. *Geol. Mag.* 65, 6 8(1928).—Dark apatite grains and apatite with dark cores occur in numerous British sediments. The Leinster granite is considered as the probable source of these grains.

Inclusion in the apatites of some igneous rocks. A. W. GROVES. *Mineralog. Mag.* 22, 92-9(1929); cf. preceding abstract.—Further occurrences of dark apatite and apatites with dark cores are recorded and the nature of the inclusions is described.

The origin of available deposits by weathering processes. FRITZ BEHREND. *Z. physik. chem. Unterricht* 41, 171-6(1928).—The formation of various minerals and rocks by daily changes in temp., mechanical action of freezing water, and by chem. changes due to water and the substances dissolved in it is discussed.

Chemical weathering in northern Norway. E. BLANCK, F. GIESECKE AND H. KRESE. *Chem. Erde* 4, 76-87(1928).—Analyses are given of fresh and weathered granite and schist and of the covering soil on the island of Hindö.

So-called kaolinization of granite under a humus cover in the Black Forest. E. BLANCK AND H. KRESE. *Chem. Erde* 4, 33-41(1928).—Analyses of bleached granite show an increase in SiO_2 and diminution of Al_2O_3 and alkalis. Kaolin is not formed from feldspar under such conditions.

The climatic conditions for the formation of German kaolin and bauxite. FRITZ KERNER-MARILAU. *Sitzb. Akad. Wiss. Wien., Abt. I*, 137, 563-94(1928).—The variation in temp. throughout the year has been studied for the German kaolin and bauxite areas. The probable temperatures during Eocene, Miocene and Pliocene time are calcd. from indirect paleontological evidence. These studies indicate the probable conditions under which kaolinization of the German rocks occurred.

A very remarkable case of saillite formation in a Mediterranean mountain climat

FRITZ KERNER-MARILAUN. *Sitzb. Akad. Wiss. Wien., Abt. I*, 137, 533-40 (1928).—The effusive rocks of southern Dalmatia have been subjected to climatic weathering. A study of the annual range of temp. shows that kaolinization and also the formation of allophane from the SiO_2 content of kaolin are influenced by the winter temp. and the abundance of rainfall. Analyses of a volcanic tuff and the altered tuff are given.

J. F. SCHAIRER
The formation of limestone. FRITZ BEHREND. *Z. physik. chem. Unterricht* 41, 220-6 (1928).—Discussion. M. BEBER

Dolomitization in the Bryozoan reefs of the Zechstein of Thuringia. E. KÖHLER. *Chem. Erde* 4, 42-64 (1928).—Partial analyses (105) of rock taken from different parts of "coral" reefs in limestones show varying amounts of MgO from traces up to that required for pure dolomite. B. C. A.

Dolomitization processes in the Palaeozoic horizons of Manitoba. D. J. BRISE. *Trans. Roy. Soc. Can.* [3], 22, Sect. 4, 215-21 (1928). The dark dendritic portions of the mottled fossiliferous limestones occurring in Manitoba were shown to be continuous by differential etching with dil. HCl and CH_3COOH . Contemporaneous dolomitization under reducing conditions accounts for the dark areas but no evidence of fucoidal origin was discovered. The darker areas are much richer in MgCO_3 than the lighter portion of the rock. J. W. SHIPLEY

Occurrence of anhydrite in the region of the steam boring at Castelnovo di Val di Cecina (Pisa). G. D'ACHIARDI. *Atti. Soc. Toscana Sci. Nat.* 35, 25-30 (1926); *Mineralog. Abstracts* 4, 82-3. Unaltered anhydrite was found with gypsum in a deep boring for steam. The origin of anhydrite is discussed. Calcareous inclusions in the rock and the presence of pyrite in the underlying quartzite are evidence of metamorphism.

J. F. SCHAIRER
Earth cementation by iron and manganese or by alumina and lime. M. HELBIG. *Chem. Erde* 4, 12-22 (1928).—Analyses are given of the cementing material in German pebble beds of recent origin. The material is the product of weathering. B. C. A.

Studies in the geology and mineralogy of soils. I. A detailed study of a region characterized by diverse rocks and partly covered by a glacial drift. R. HART. *J. Agr. Sci.* 19, 90-105 (1929). An account is given of a small area at Boghall, Midlothian, Scotland. The soils are derived mainly from glacial deposits and alluvium. The underlying rocks are lavas, sandstones and shales. A similarity in mineral content of the soils on glacial material and alluvium is shown, all having a high content of fresh Fe silicates. The soils on the screes and hill-wash are characterized by their content of rock fragments and Fe oxides. The soils on the drift material contain K, P_2O_5 and Ca-bearing minerals. The varied nature of the parent materials has given rise to varied textures in the soils. The mineral content of the matrix of the boulder clay is similar to that of the local rocks, only the rarer minerals being derived from external sources. P. R. DAWSON

Calcareous concretions in the Upper Marine series, Singleton district, New South Wales. H. G. RAGGATT. *Proc. Linn. Soc. N. S. Wales* 54, Pt. 3, 149-61 (1929).—Calcareous concretions $8 \times 10 \times 5$ ft. occur over an area of 220 sq. mi. 250 ft. above the Murree beds in New South Wales. They were probably formed contemporaneously with the enclosing rock in a relatively warm shallow sea subject at times to the influx of cold H_2O by bacteria or by the heating of H_2O satd. with carbonate. ALDEN H. EMERY

Capsular silica. FREDERICK A. BURT. *Am. Mineral.* 14, 222-6 (1929).—The material was found in the Quaternary formations of Brazos Co., Tex. Its appearance is that of a group of fully and partially developed cubic crystals on whose faces are regular capsules arranged in 2 systems at right angles to each other. The capsules are translucent and light agate-blue with hardness 6.5 and sp. gr. 2.63. They are composed of coarsely fibrous chalcedony extending inward with the cubes like inverted cones. The silica was deposited as a replacement, possibly of pyrite crystals. A. M. BRANT

The space filling of atoms (ions) in crystals and the character of the lithosphere. V. M. GOLDSCHMIDT. *Neues Jahrb. Mineral. Geol., A, Beil.-Bd.*, 57, 1119-30 (1928).

J. F. SCHAIRER
Occurrence of free sulfuric acid in groundwater. E. SCHROEDTER. *Chem. Erde* 4, 70-5 (1928).—Soils taken at various depths on the plains near Danzig show the presence of small amts. of free H_2SO_4 . B. C. A.

The solfatara. A. RITTMANN. *Naturwissenschaften* 17, 659-63 (1929).—A description of the solfatara near Naples. Compn., temp., etc., of the exuding gases are given. B. J. C. VAN DER HORVEN

The presence of nitrogen compounds in Etna ashes. G. GRASSI-CRISTALDI AND A. GIAMMONA. *Ann. chim. applicata* 19, 128-36 (1929).—Exact measurements of the quantity of N in ashes from Etna show that NH_3 is always evolved in their decompos.

and the amt. varies, 0.025 to 0.074% having been found. The decompn. has been accomplished by means of H_2SO_4 and KF rather than HF, since the former are always free from NH_3 . A. W. CONTIERI

Origin of helium-rich natural gas. R. C. WELLS. *J. Wash. Acad. Sci.* 19, 321-7 (1929).—By fractional diffusion through ball clay, an original mixt. of H_2 and CO_2 contg. 2.6% H_2 was enriched in 7 stages to over 90% H_2 . Helium would behave like the H_2 and He-rich natural gas may have been so formed. ALDEN H. EMERY

The significance of symmetry centers for the derivation and systematics of the 32 crystal classes (VALETON) 2. Characteristic properties of the typical harmonic crystal units (KALB) 2. A new rotating-crystal method (GELLER) 2. The relation of gas bubbles on the surface of growing crystals to the acceleration of crystallization (BERNAUER) 2. Crystal growth (SPANGENBERG) 2. The universal symmetry elements (NIGGLI) 2. Kinematics of the growth of crystals (ERNST) 2. The constitution and the structure of ultramarine (JAEGER) 2. Some notes on a portion of the Lizard Springs antichine (SKELTON) 22. Analysis of a peat profile (THIESSEN, JOHNSON) 21. The fine structure of gypsum (ONORATO) 2. Alkali-Al silicates I. Synthetic study of nepheline (GRUNER) 6. The space group of stibnite (GOTTFRIED, LUBBERGER) 2. Co-ordination numbers (RAWLINS) 2. Artificial preparation of diamonds (SESTA) 2. The use of a quartz lamp in qualitative analysis [of minerals] (KUBELKA) 2.

9—METALLURGY AND METALLOGRAPHY

D. J. DEMOREST, R. H. ABORN

Current metallurgical research at the Bureau of Standards. H. S. RAWDON. *Metals and Alloys* 1, 144-52(1929).—The various research projects are described. A. J. MONACK

Some methods of research in physical metallurgy. WALTER ROSENHAIN. *J. Inst. Metals*, Advance copy No. 509, 36 pp (1929).—A description of methods developed in recent years (from 1906 to the present date) for the study of metals, especially in connection with the detn. of equil. diagrams. It is limited to work done in Great Britain, especially at the National Phys. Lab. and by R. ROBERT F. MEHL

The manganese deposits of the world. FRIEDRICH LOHMANN. *Intern. Bergw. u. Bergtech.* 22, 283-90(1929) E. J. C.

The tin occurrences in the Bohemian Erzgebirge. ANT CHLUPSA. *Montan. Rundschau* 21, 317-24(1929).—Historical review of the mining for Ag and Sn in the Bohemian Erzgebirge. The possibility of reviving the mining for Sn is discussed. In the av. the ore contains 1-2%, but quite often the content is as high as 4-6%. G. S.

Zinc in Canada. CHARLES CAMSELL. *Metal Ind.* (London) 35, 204-7, 302-3 (1929). E. J. C.

Foreign iron ores, present and reserve. CHARLES HART. *Mining Met.* 10, 468-71 (1929). E. J. C.

The hydraulic classification of minerals. G. BOZZA. *Giorn. chim. ind. applicata* 11, 151-4(1929).—B. discusses mathematically Fahrenwald's principles of ore classification by flotation methods (*C. A.* 22, 1560). It is shown that the settling as caled. is quite different from the exptl. detns. A. W. CONTIERI

Development of ore preparation technic in 1928. H. MADEL. *Metall u. Erz* 26, 428-40(1929).—An address with special attention to methods of flotation. H. STOERTZ

Differential flotation. W. PETERSEN. *Metallhose* 19, 1769-70, 1826-8, 1882-3, 1937-8(1929).—A review, with bibliography. W. C. EBAUGH

Floating of carbonate and oxide manganese ore—a further step in the utilization of low-grade reserves. F. D. DEVANEY AND J. B. CLEMMER. *Eng. Mining J.* 128, 506-8(1929).—Exptl. work conducted by the Bureau of Mines and its cooperating agencies at Salt Lake City, Utah, Tuscaloosa, Ala., Rolla, Mo., and by com. firms has shown many of the non metallic minerals such as phosphate rock, fluorspar, bauxite and limestone can be sepd. from their gang minerals by flotation. Mn carbonate (rhodochrosite) and the Mn oxides, pyrolusite, psilomelane and manganite, can be added to the list. It has been found that all the Mn ores studied—oxides, carbonates or silicates—are attracted by a high-intensity magnetic current. Flotation effects a good sepn. of rhodochrosite and rhodonite, the former floating. 96% of the Mn in oxide ores is recoverable in a concentrate and 97% of the insol. gang material is rejected. The floating agents are pine oil, oleic acid, Na silicate and Na_2CO_3 . For best results

the reagent charge must be adapted to each ore treated. Heating the pulp to a temp. above the m. p. of the fatty acid decreases the amt. of reagent required and materially speeds up the flotation process. Com. application appears most promising.

W. H. BOYNTON

The Lucky Tiger concentrator. ALBERT B. SABIN. *Mining Met.* 10, 415-7 (1929).—The milling procedure is explained for the all flotation mill of the El Tigre Mining Co. of Sonora, Mexico, operating on 200-300 tons daily of both sulfide and oxide ores, averaging over 30 oz. in Ag and some Au.

DOWNES SCHAAF

Factors governing removal of soluble copper from leached ores. JOHN D. SULLIVAN AND ALVIN J. SWIFT. *Bur. Mines, Tech. Paper* 453, 26 pp. (1929); cf. C. A. 23, 3423.—Time of diffusion of pregnant Cu solns. from ore bears a linear relationship to the size of particles. Approx. 15% more Cu is retained in the residue at 2-3° than at 20°. Influx of solns. is accelerated by low temps. Leach solns. should, therefore, be added at night and wash solns. in the daytime. By alternate wetting and drying the Cu can be removed in 15-20% of the time required in flood washing. In drying, crystals are formed near the surface and capillarity then pulls the soln. outward.

ALDEN H. EMBRY

Development of a copper-extraction process. HARMON E. KEYES. *Eng. Mining J.* 128, 545-7 (1929).—Segregation of fines in leaching units suggests their sep. treatment. An account of the exptl. work and proposed plant of the Zonia Copper Mining Co. shows some of the recent progress in Cu leaching. The flow sheet of the "solids" shows the most important items in the design of the proposed 600-ton plant and a few of the features differing from standard practice are briefly discussed.

W. H. BOYNTON

Gold-ore treatment. CHARLES BUTTERS. *Eng. Mining J.* 128, 361-3 (1929).—B. believes amalgamation is losing its place in Au recovery, largely due to prohibitive labor costs. A wider scope for flotation and for cyaniding in capable and experienced hands is seen.

W. H. BOYNTON

Manganese ore by the Bradley process. CARL ZAPFFE. *Mining Met.* 10, 428-9 (1929).—Certain data are presented which were obtained to calc. the size and capacity of the various units used to produce 50 tons of Mn(OH)₂ per 24 hrs. by the Bradley process for obtaining the Mn and Fe values from crude Mn ores.

DOWNES SCHAAF

Problems in roasting zinc ores. GEORG BALZ. *Metall. u. Erz* 26, 441-7 (1929).—A discussion of problems involved in the roasting of Zn ores. This includes roasting Zn blende to obtain metallic Zn by distn. between 800° and 1000°, and roasting mixed and complex ores to obtain metallic Zn by electrolysis at temps. between 600° and 800°.

H. STOEHRZ

Material and heat balance of a few melts in a Brackelsberg furnace. PETER BARDENHEUER AND KARL L. ZEYEN. *Mitt. Kaiser-Wilhelm-Inst. Eisenforsch. Düsseldorf* 11, 237-46 (1929); cf. C. A. 23, 1852, 5137.—A few Fe melts were run through the coal-dust-fired revolving furnace of Brackelsberg, material and heat balance being carefully detd. For 3 runs, thermal efficiencies of 32.55, 28.70 and 40.74% were obtained.

H. STOEHRZ

The problem of treating cupriferous precious-metal ores by the cyanide process. A. C. HALFERDAHL. *Eng. Mining J.* 128, 350-7 (1929).—An exhaustive research into methods and practice with a survey of the literature. A résumé is given of important patent situation features. Conclusions: (1) Electrolysis of original-ore cyanide solns. has been unsuccessful in pptg. the Cu and regenerating the cyanide; (2) NH₄CN treatment is still in the lab. stage; (3) regeneration of acidification of residual plant soln. will recover about 50% of the bound cyanide; and (4) treatment of sludge ppt. involves consideration of its chem. character. A good bibliography is included.

W. H. BOYNTON

Effect of copper and zinc in cyanidation with sulfide-acid precipitation. E. S. LEAVER AND J. A. WOOLF. *Am. Inst. Mining Met. Eng., Tech. Pub. No.* 250, 23 pp. (1929).—Lab. expts. show the possibilities of cyanidation of Au-Ag ores contg. less than 0.5% of cyanide-sol. Cu and the effect of Zn in the cyanide soln. The proposed process is based on the regeneration of about 80% of the cyanide used in the soln. of Cu. Regeneration is obtained by a combination of the sulfide and the acid pptn. of the Cu and Ag. The resultant soln. is made alk. with lime and the Au is pptd. with Zn dust. The regenerated cyanide soln. is as active as a fresh soln. in the soln. of precious metals. The amt. of Na₂S used is proportional to the metals to be pptd., while H₂SO₄ consumption varies as the strength of the pregnant soln. in total cyanide, and lime or free alkali. The presence of Cu in a cyanide soln. in amts. not exceeding 10 lb. per ton (5 kg. per 1000 kg.) does not diminish the solvent action of cyanide provided the soln. contains free cyanide equal to the quantity needed in fresh soln. to obtain max.

extrn. $\text{Cu}_2(\text{CN})_2$. NaCN soln. in the absence of free cyanide is but a weak solvent for the precious metals. Zn dust is readily sol. in cyanide soln. necessitating the avoidance of excess over the amt. needed for pptn. of the metals. The expts. support the pptg. method (Na_2S and H_2SO_4) as a practical means of removing Cu and Zn from cyanide soln. regenerating most of the combined cyanide in a form effective for soln. of the precious metals. The application of cyanidation should be confined to precious metal ores in which Cu is under a smelting grade.

W. H. BOYNTON

Utilization of secondary metals in the red brass foundry. H. M. ST. JOHN. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 242*, 10 pp. (1929).—The proper selection, treatment and utilization of secondary metals in the red brass foundry are discussed.

DOWNES SCHAFF

Foundry iron smelting and re-melting parallels recent blast furnace and cupola practice. J. E. FLETCHER. *Bull. Brit. Cast Iron Research Assoc.* 1929, 147-62.—See C. A. 23, 4427.

DOWNES SCHAFF

The reduction of shrinkage cavities and vacuum melting. W. J. P. ROHN. *J. Inst. Metals*, Advance copy No. 508, 12 pp. (1929).—Shrinkage cavities in ingots may be diminished by the use of H_2O -cooled molds, which allows solidification to start at the bottom and advance gradually to the top end. Special construction of such molds, to be used in connection with vacuum melting furnaces, is described, and some details are given regarding vacuum melting.

DOWNES SCHAFF

Baking practice for oil-sand cores. H. L. CAMPBELL. *Foundry Trade J.* 41, 224; *Univ. Mich. Dept. Eng. Research*, Reprint Series No. 5, 289-94 (1929).

E. J. C.

Fluxes and metallic correctives for non-ferrous metals. NEVILLE DEANE. *Metal Ind.* (London) 35, 222 (1929).—"Flux" should designate substances which "make fluid" the non-metallic portions of a charge and produce a slag. It may or may not influence the metallic part of the charge. A metal or semi-metal added with the object of alloying or combining with the metal is more strictly a "corrective." True fluxes for non-ferrous metals include: borax, soda ash, fluorspar, cryolite, NaCl and other chlorides, sand, charcoal, flour, coal, sawdust and cream of tartar. The latter evolves CO on melting, which is very efficient as a deoxidizer. ZnCl_2 is the best flux for Al, with mech. rather than chem. action. Fats, waxes and resins are oxidation preventatives, but are scarcely true fluxes or deoxidizers.

W. H. BOYNTON

The microscopical study of cast iron and its relation to the foundry. E. HOWELL. *Proc. Soc. Chem. Ind. Victoria* 27, 1397-1407 (1927); cf. C. A. 21, 1613.—A discussion of Australian practice in foundry work, with special reference to microscopical studies conducted by the Broken Hill Proprietary Co., Ltd., to assist the foundry industry.

W. C. EBAUGH

X-ray inspection of castings. ANCEL ST. JOHN. *Fuels and Furnaces* 7, 1371-2, 1407-8 (1929).—"X-ray inspection is now an accepted method of detg. the suitability of many kinds of material for peculiar or severe working conditions." Intelligent x-ray examn. serves the foundryman in 2 important ways. Applied to pilot castings it det. whether the design and foundry practice are correct and can indicate changes necessary to improve the product. Applied to products made by correct procedure, it can convince prospective users that these castings are suitable for the service contemplated.

W. H. BOYNTON

Centrifugal casting—adaptability to high-explosive steel shells. ROY E. PAINE. *Army Ordnance* 10, 117-24 (1929).—Salient features in the development and application of centrifugal casting are discussed, and suggestions are offered toward adapting this method of casting to the production of high-explosive steel shells.

D. S.

Reclaiming non-ferrous scrap metals at manufacturing plants. FRANCIS N. FLYNN. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 233*, 7 pp. (1929).—The reclamation of non-ferrous scrap metals in automobile mfg. plants by smelting in a pig Fe melting cupola is more efficient than when using a water-jacketed cupola.

DOWNES SCHAFF

Conversion of scrap iron into synthetic gray iron in the cupola. W. J. MERTEN. *Fuels Furnaces* 7, 1367-70 (1929).—A discussion of some improvements that may be brought about in gray iron melting practice in the cupola by the proper selection of scrap and correct furnace manipulation, which permit marketing of the castings at a lower cost than where the improvements are attempted by the addn. of alloying elements. It is shown that an iron of pearlitic structure can be economically produced without alloying elements such as Mn, Cr, Ni, Mo, etc.

W. H. BOYNTON

Recovery of waste from tin-base babbiting operation. P. J. POTTER. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 236*, 5 pp. (1929).—The metal removed from tinning pots is agitated with steam to dross off any Zn, and the Sn-Cu alloy remaining is used.

in babbitt mixts. The Zn dross is smelted. Sn skimmings from the kettles, as well as spatters and spills from babbitting operations, are sweated at fairly low temps. and the Zn is drossed off by steaming. The residue is smelted. Turnings, punchings, broachings, gates and scrap from die-casting operations, scrap die-cast bearings and bushings that are free from Fe, steel, bronze or other contamination are melted in a large kettle. This melt is freed from oxides, Fe and non-metallic inclusions with S and rosin and the drosses are smelted. The cleaned melt is analyzed and 50% or more new metal added to specification. The various drosses are mixed with coal or other reducing agent and reduced in a smelting reverberatory. The metal is tapped and refined with S and rosin.

H. C. PARISH

Metallization of the oxide of iron in ilmenite. R. J. TRAILL AND W. R. MCCLELLAND. *Can. Chem. Met.* **13**, 265-8, 272(1929).—See *C. A.* **23**, 3194.

W. H. B.

Antimony refining. EDMUND R. THEWS. *Metallhorse* **19**, 2049-50, 2105-6(1929).—The usual refining methods for Sb are reviewed, with analyses of finished products appended, and the conclusion is drawn that the customary method of grading Sb in trade (by the structure or appearance of the metal) is not a safe criterion of its purity. A clever operator can give the required appearance even to an inferior grade of Sb.

W. C. EBAUGH

Recent progress in the metallurgy of quicksilver. W. G. ADAMSON. *Eng. Mining J.* **128**, 503-5, 508(1929).—A brief discussion of the ore equipment and operation of the mine and plant of the Pershing Quick-silver Co. at Lovelock, Nev. A Gould rotary calcining furnace and a Nichols Herreshoff roasting furnace are equipped with sep. condensing systems up to the last stage, in which operation low-temp. gases from both furnaces enter the same wooden settling tanks. Increased efficiency of the dust arresters in the plant has minimized the effectiveness of the large settling tanks, and their role in the saving of the "quick" is a doubtful one. Assays of regularly burned calcine from both furnaces show a trace of Hg and the stack loss is practically nil.

W. H. BOYNTON

Powdered fuel in metallurgical work. W. O. RENKIN. *Trans. Fuel Conference, World Power Conference, London 1928* **3**, 407-37(1929), cf. *C. A.* **23**, 1374, 4173, 5136.

ALDEN H. EMERY

Fuel saving in steel making. B. DE MARÉ. *Mining Met.* **10**, 417-8(1929).—A 5-weeks run on a 75-ton open-hearth steel furnace of the Worth Steel Co., of Claymont, Del., rebuilt according to the Kuehn system, shows a 10% increase in output and a saving of 28% of fuel when using a low-grade asphaltum base oil.

DOWNS SCHAAF

Pusher type furnaces used in heat treating forgings. W. N. ROBINSON. *Fuels and Furnaces* **7**, 1421-4, 1428(1929). The new furnace installation in the forge shop of the Transue-Williams Steel Forging Corp. at Alliance, Ohio consists of a continuous-type oil-fired billet heating furnace, gas fired, in- and out type forging furnace, electrically heated continuous-type hardening and tempering furnaces, and electrically heated nitriding furnace. These furnaces are illustrated and their operation is outlined.

W. H. BOYNTON

Blast-furnace gas cleaning. W. J. MCGURTY. *Iron and Steel Eng.* **6**, 424-6(1929).—The caloric value and constitution of blast-furnace gas, together with the vol. produced, will naturally vary with the amt. of C-bearing materials in the burden. It has been detd. that the gas will contain 45-68% of the calorific value of the coke used, the higher figure referring to ferro-manganese operations. Blast furnace gas contains: (1) true dust- particles of ore, stone, coke, etc.; (2) fume- sublimates of metallics and non-metallics and (3) vapors of the above constituents which must be cooled before their transition to the solid phase. Each group is discussed.

W. H. B.

Certain principles in the extended utilization of blast-furnace gas. OWEN R. RICE. *Iron and Steel Eng.* **6**, 176-81(1929).—The applicability is discussed of blast-furnace gas for use: under boilers, in steel-heating furnaces, under by-product coke ovens, and in hot blast stoves. Of these, the underfiring of coke ovens appears to be the most attractive with the advantage contingent upon the possibilities of marketing the coke-oven gas released to industrial and domestic uses.

W. H. BOYNTON

Blast-furnace filling and size segregation. C. C. FURNAS AND T. L. JOSEPH. *Am. Inst. Mining Met. Eng., Tech. Pub.* No. 249, 29 pp.(1929).—Efficient operation of a blast furnace requires contact between the gas stream and the solid particles. This implies uniform distribution of particle size from the inwall to the center, which is not found in com. furnaces. Uniformity of the stock column can be partly controlled by methods of charging. The av. particle size at the center may be diminished by (a) keeping the stock line close to the bell, (b) increasing bell angle, (c) increasing distance and speed of bell drop, (d) increasing bell clearance. The av. particle size at the center

may be increased by (a) reversing a, b, c and d previously mentioned, (b) charging the coke on the big bell before the ore, (c) diminishing the size of the round, (d) mixing the ore and coke before charging. Also it will assist in obtaining uniform particle size if pieces of the ore over 2 in. are crushed and if 65-mesh material is sintered into a cake. It has been found helpful to divide ore into 3 sizes and to charge each separately.

H. C. PARISH

Notes on the damping-down and restarting of blast furnace. C. S. GILL. *J. Iron Steel Inst.*, Advance copy No. 4, 7 pp. (Oct., 1929).—The general principles and methods of damping-down and restarting blast furnaces are noted, and details are given for 2 blast furnaces, one having a shut-down period of 175 days, the other having a length of stand of 338 days.

DOWNES SCHAAP

Metallurgical phenomena and formation of texture in the process of welding. W. ZIMM. *Schmelzschweissung* 7, 108-14, 121-8; *Chem. Zentr.* 1928, II, 1816.—The general metallurgical phenomena in welding and the gas-weld seams are discussed. The peculiarities of the weld seams produced by means of C_2H_2 and O_2 were examd. Chem. influences in connection with the welding flame and the mfg. processes are reviewed and the phys. states of the texture and their possible alteration are discussed.

G. SCHWOCH

Methods of research in metallography. G. MASING. *J. Inst. Metals*, Advance copy No. 507, 19 pp.; *Engineering* 128, 359-61, 391-3 (1929).—The problems of metallographic research methods are summarized. Researches on the constitution of alloys must be based on the well-established thermodynamical laws of heterogeneous equilibria.

DOWNES SCHAAP

X-ray metallography in 1929. GEORGE L. CLARK. *Metals and Alloys* 1, 153-61 (1929); cf. *C. A.* 23, 5137.—C. considers the detn. of grain size, internal strain, grain orientation, the x-ray analysis and control of heat treatment and recrystn.

A. J. MONACK

Metal crystal orientation. I. Determination of orientation of metallic single-crystal specimens by high-voltage x-rays. THOS. A. WILSON. *Am. Inst. Mining Met. Eng., Tech. Pub.* No. 210, 18 pp. (1929).—The orientation of a single crystal is quickly detd. from Laue photograms obtained with high-voltage x-rays. A Laue photogram is taken with the beam normal to one face of the crystal; then others are taken with the specimen rotated so that one of the spots on the original photogram would be brought into coincidence with the zero beam impression. The orientation is detd. by gnomonic or a combination of gnomonic and stereographic projection. The soln. of the orientation of a single crystal of silicon steel is given as an illustration of the method.

A. J. KING

Determining orientation of crystals in rolled metal from x-ray patterns taken by monochromatic pin-hole method. WHEELER P. DAVEY, C. C. NITCHIE AND M. L. FULLER. *Am. Inst. Mining Met. Eng., Tech. Pub.* No. 243, 10 pp. (1929).—A full account is given of a previously noted method (*C. A.* 23, 4606), which is applicable to orientation studies irrespective of the degree of preferred orientation and which may be used where one preferred orientation, a system of orientations, or even several systems of orientations obtain; with an application of the method to rolled Zn. A Zn-sheet was hot-rolled from 0.5 to 0.1 in., then cold rolled to 0.006 in. and the method for orientation applied with the reflection technic. The hexagonal axis was at an angle of $61^\circ \pm 18^\circ$ to the rolling direction. No preferred orientation with respect to the rolling plane was found. Crystals exist at any position about the rolling direction so long as their hexagonal axes have the proper relation to the rolling direction.

ROBERT F. MEHL

Idiomorphic crystals of cuprous oxide in copper. CLEMENT BLAZEY. *J. Inst. Metals*, Advance copy No. 500, 4 pp. (1929).— Cu_2O usually occurs in Cu and Cu alloys in dendrites, or irregular eutectic masses. The occurrence of cryst. Cu_2O has been observed in a sample of Cu which was heated for nearly a year on a furnace floor. The form and character of these idiomorphic crystals are described and illustrated by photomicrographs and sketches.

ROBERT F. MEHL

Studies on the crystallization of gold from the liquid state. C. O. BANNISTER. *J. Inst. Metals*, Advance copy No. 499, 4 pp. (1929); *Chem. News* 139, 184-5; cf. *C. A.* 8, 1257.—Radial crystn. from centers of crystn., giving approx. circular strata well marked in relief, may be obtained by addn. of traces of Pt metals having higher m. ps. than Au (such as Pt, Ir and Ru). These traces diminish undercooling and practically eliminate the phenomenon of "flashing," characteristic of pure Au. The same result is obtained by touching the solidifying metal with a Au wire. When crystn. proceeds by "flashing" no trace of radial (circular) crystn. may be seen; the metal forms a

finer-grained polygonal structure. These facts are illustrated by photomicrographs. Addnl. photomicrographs illustrate the formation of straight boundary lines by the interference of radial growth from 2, 3 and 4 nuclei and the formation of curved boundary lines by retardation of growth from 1 center.

ROBERT F. MEHL

Crystallization and segregation phenomena in 1.10 percent carbon steel ingots of smaller sizes. AXEL HULTGREN. *J. Iron Steel Inst.*, Advance copy No. 6, 45 pp. (1929).—The steel investigated contained on an av. 1.10% C, 0.20% Si, 0.30% Mn, 0.012% P and 0.009% S, and was made in a basic elec arc furnace. Ferro-silicon was added in the furnace and Al usually in the ladle though sometimes in the mold. The ingot sizes were 4–12 in. square on top, with rounded corners. The molds were generally cold or slightly warm. A preheated refractory sink-head was used and the ingots were top-poured, big end up. Longitudinal slabs were cut, and usually axial sections were prepd. from the ingot and etched to develop the solidification structure. Two etching methods were used—"mild," to bring out details of crystn., and "strong," to bring out segregation. Some of the results obtained are: Some of the smaller crystals of random orientation forming in the first solidified skin are elongated and form systems of parallel, partly disconnected, slender cruciform stems. The av. direction of the elongated crystals at their base is perpendicular to the f-p. isothermal on transition from surface crystals to elongated crystals. From the stems grow transverse branches, which branch further, in the directions parallel to the 3 tetragonal axes of the crystal, resulting in a dendritic structure. The deforming stresses on the growing surface layer caused by suppressed contraction of the steel and the expansion of the mold lead to inverse segregation at the surface and to crystal deformation. When the steel solidifies as δ -iron and then transforms to austenite a secondary (transformation) structure is formed, often consisting of elongated grains. Crystn. at the ingot center is from independent nuclei, and produces a large-grained dendritic structure. Stirring during crystn. produces a finer grain. The causes of segregation are discussed, and the importance of the relative movement between solid and liquid during crystn. is pointed out. Segregation in the ingot interior is of 3 main types: inverse-V structure in intermediate zone, upright-V in axial region and sedimentary in axial region. An appendix (in collaboration with GUNNAR LILLJEKVIST) describes the prepn. and etching of the ingot sections. Also in *Iron Steel Ind. Brit. Foundrymen* 3, 15–20; *Blast Furnace & Steel Plant* 17, 1511–6 (1929).

ROBERT F. MEHL

Metal grain and crystal lattice. ADOLF SMEKAL. *Mitt. staatl. tech. Versuchsanstalt* 16, 72–83 (1927); *Chem. Zentr.* 1928, I, 747–8, cf. *C. A.* 22, 3074.—The difference in breaking strength of ideal and real crystals is due to the presence of "empty places" in the latter. These "empty places" in crystals may be recognized by irradiation; they are produced by atoms which are not regularly placed in the lattice and are present in the ratios 1:1000 to 1:10,000. They can be filled by the addition of other substances, which are normally present in alloys as impurities. The type of addition cannot be predicted. These additions increase the breaking strength. ARTHUR FLAISCHER

The internal structure of the pearlite grain. N. T. BELAIEV. *Rev. métal.* 26, 424–6 (1929); cf. *C. A.* 19, 2800.—Suppose a spherical grain of pearlite, in which the ferrite and cementite lamellas are vertical, is cut by an equatorial plane; the distance observed between the cementite lamellas under the microscope will be the true distance. But if the grain is cut by a plane inclined at an angle ω to the equatorial plane, the true distance is $\cos \omega$ times the observed distance. With very fine pearlites, the distance is best measured with $\omega < 80^\circ$. As in steels that have not been subjected to heat treatment the actual distance between the cementite lamellas is in the neighborhood of 300–350 μ it would seem that there is a tendency for the thickness of the ferrite lamellas not to exceed the edge (250 μ) of the small cubes. B. suggests that in the finest pearlites, where the distance between the lamellas is $< 300 \mu$, the lamellar pearlite should possess different phys. properties from those of ordinary lamellar pearlite. Micrographic examn. of pearlitic steels of known mech. properties can bring out the fact that the mech. properties, e. g., elasticity, change with the distance between the lamellas, and it might be possible to consider certain of these properties as functions of the lamellar distance.

A. PAPINEAU-COUTURE

Crystalline grains in castings. A. GLAZUNOV. *Foundry Trade J.* 41, 117–20, 131–4 (1929).—A crystallite or crystal-grain may be a single allotriomorphic crystal, or a definite complex group of crystals, according to different authorities. The growth of crystallites in a solidifying metal or alloy is discussed in various aspects. Spheroidal forms are obtained if the surface tension is high. The formation of grains by dendritic arrangement of atoms is described and illustrated. The growth of grains is a phase of the general tendency to attain max. stability by decrease of surface area and energy.

The formation of various types of crystal-grains is described in detail, and the relations are shown between the various factors governing form, homogeneity, etc., in pure metals and in binary alloys of solid soln. and of eutectic types. The term "crystallite" is best confined to a grain formed from one nucleus, and this grain may be chemically homogeneous or heterogeneous. The grains tend to become homogeneous by diffusion. In a pure metal the dendrites are not primary but are the result of homogeneization. The crystallites of a eutectic cannot become homogeneous. GEO. F. COMSTOCK

The origin of the structure of castings. G. TAMMANN. *Z. Metallkunde* 21, 277-82 (1929).—An exposition of T's well-known views upon the subject of crystn., under the headings: the m. p. and the f. p.; no. of crystn. nuclei; the linear crystn. velocity; the formation of grains; variations in grain size; columnar crystn.; capillary porosity in castings; intercryst. material. ROBERT F. MEHL

The mechanical strength of metal castings including iron in dependence upon the method of casting. G. SCHREIBER AND H. MENKING. *Z. Metallkunde* 21, 297-302 (1929).—The reasons for the generally observed variations in mech. strength in a casting are discussed. Previously published work (cf. *C. A.* 22, 569) is here extended by a series of expts. on Elektron alloy, in which the previously used pattern of casting is again employed, and in which the effect of the position of the casting with respect to the mold, the way in which the metal is introduced into the mold, the dimensions of the risers, the pouring temp., and the water content of the form, are investigated. Curves are given showing the distribution of the tensile strength values throughout the casting in relation to these factors. It is possible from these studies greatly to increase the quality of castings if cost is not too important. These studies are being extended to other metals and alloys. ROBERT F. MEHL

The method of centrifugal casting. H. SIMON. *Z. Metallkunde* 21, 302-4 (1929).—General discussion under the following headings: historical, centrifugal casting of iron and non-ferrous metals and alloys, simple and difficult castings, desirable properties, centrifugal castings and sand castings. ROBERT F. MEHL

Technical problems in the solidification of metals. G. MASING. *Z. Metallkunde* 21, 282-5 (1929).—A general discussion under the following headings: columnar crystn.; pipes, porosity and shrinkage; direct and inverse segregation; intercryst. material. ROBERT F. MEHL

The shrinking of metals. F. SAUERWALD. *Z. Metallkunde* 21, 293-6 (1929).—Shrinking is defined as the change in linear dimensions of a body from the beginning of crystn. to room temp. No special problem is concerned for equi. conditions, but under practical conditions equi. does not obtain, and it is found that shrinkage is greatly influenced by different casting conditions. Conditions altering shrinkage (and shrinkage nos) are listed (cf. *C. A.* 22, 1128). Expts. were carried out to det. the relative effects of these various conditions. The app. used is described. The effect of H upon freezing Cu is to give deviations from the normal contraction curve, caused by the formation of gas pockets. Shrinkage curves are given for Cu-Sn alloys with 230, 20, 5 and 2.5% Sn, which show changes in slope analogous to corresponding transformation points in cooling curves. Some of the alloys showed a significant expansion at the beginning of freezing, which can be explained by the sepn. of gases and crystal liquida-tion. The magnitude of the expansion depends upon the amt. of H in the alloy, as shown by alloys heated in H and A mixts. and in pure A, though the expansion is not completely removed by the exclusion of gases. ROBERT F. MEHL

The structure of cast metals and alloys. FOSTER C. NIX AND E. SCHMID. *Z. Metallkunde* 21, 286-92 (1929).—Columnar crystals obtained with various metals and alloys cast in an ingot mold were examd. for orientation with respect to the direction of solidification. Single-phase systems (pure metals and solid solns.) and binary eutectics were examd. Among the single-phase systems were an $\alpha(\delta)$ -Fe-Si solid soln. with 4.3% Si and a β -brass as representatives of body-centered cubic metals. β -brass gave a simple fiber texture with the [100] direction parallel to the major axis of the columnar crystals. The Fe-Si solid soln. gave less distinct results, indicating that some direction (probably the [100]) in the cube face was parallel to the major axis of the columnar crystals. Face-centered cubic metals and one face-centered cubic alloy (Al, Cu, Ag, Au, Pb and α -brass) all gave similar fiber textures, with the [100] direction parallel to the length axis of the columnar grain. The tetragonal metal investigated, white Sn, showed the face diagonal of the basal face [100] to be parallel with the length axis. The close-packed hexagonal metals, Zn and Cd, gave the hexagonal axis [0001] perpendicular to the length axis. Mg showed a diagonal axis of the first class [1010] parallel to the direction of the length axis; it differs from Zn and Cd which may have any direction in the basal plane parallel to length axis of the columnar crystal. Bi,

which is rhombohedral, gave the [111] direction parallel to the length axis. Thus the length axis of the columnar crystals investigated always corresponds to a densely packed crystal direction except with Zn and Cd where the axes on the basal plane are apparently all equiv. The binary eutectic of Al and Si gave a fiber texture only for the Al which was the characteristic [100] direction while the Si crystals were random in their distribution. The Zn-Cd eutectic showed the above-mentioned characteristic fiber textures for both the Zn and the Cd. The genesis fiber textures of columnar crystals are ascribed to an anisotropy in the velocities of growth of the metal crystals.

ROBERT F. MEHL

Results show shear test is unsatisfactory for testing cast iron. W. JOLLEY. *Foundry* 57, 779-83(1929).—The present shear test methods are shown to give such non-uniform results that they are not satisfactory in evaluating the phys. properties of cast Fe.

DOWNES SCHAAF

The heat-treatment of gray cast iron. EDWARD E. MARBAKER. *Foundry Trade J.* 41, 153-5(1929); cf. *C. A.* 22, 3612

DOWNES SCHAAF

Heat treatment of cast iron and malleable iron. H. BORNSTRIN. *Fuels and Furnaces* 7, 1377-83(1929).—The various heat treatments used in annealing gray cast iron and their adaptation to a particular class of castings, the production of white cast iron for malleable, its properties and heat treatment are discussed. Three general classes of heat treatment are used for gray cast iron: (1) heating at a low temp. (not over 538°) to relieve internal strains and cooling in the furnace or in air; (2) heating at a higher temp. (above the crit.) to relieve strains and to increase machinability with cooling in the furnace or in air; (3) heating above the crit. point followed by an oil or water quench to increase hardness. This treatment may or may not be followed by a draw. Several photomicrographs and curves are shown.

W. H. BOYNTON

Overheating cast iron. PETER BARDENHEUER AND KARL L. ZEYEN. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf* 11, 225-35(1929). Cast Fe melts with varying C content were overheated for 15 min. at about 1350° in different stages. With high C and normal Si and Mn content, the graphite was more finely divided by this process and mech. strength was increased. With low C, flexure strength becomes less as overheating is increased and with P- and S-poor material the tensile strength likewise becomes less. This decrease in physical properties is ascribed to the formation of dendrites surrounded by a graphite net. In the case of P- and S-poor alloys, this loss in phys. strength is worse, because here there is a tendency to form a network of finely divided graphite eutectic, shot through with ferrite crystals. The unfavorable effect of this overheating can be avoided by increasing the Si content to about 1.5% or more. The presence of such constituents as Cr increases the sensitivity of overheating.

H. STOERTZ

Vanadium and titanium in cast iron. J. E. HURST. *Foundry Trade J.* 41, 173-4, 176(1929). Previous investigations studying the influence of small admns. of V and Ti to cast Fe are reviewed and valuable possibilities are discussed in the com. development of cast Fe contg. V and Ti.

DOWNES SCHAAF

The solubility of oxygen in iron and in ferrous oxide ("oxoferrite," "wüstite"). C. BENEDICKS AND H. LÖFQVIST. *Jernkontorets Ann.* 83, 348-55(1928).—The diagram for the system: Fe-O₂ given previously (*C. A.* 22, 937) has been contradicted by the results of Schenck, *et al.* (*C. A.* 22, 566). B. and L. discuss the influence of foreign substances on the detn. of the equil. with O₂. The high soly., 6.7% O₂ in Fe, found by A. Matsubara (*C. A.* 15, 1683) is attributed to Mg from the reaction vessel. The high soly. (2.8% O₂ in Fe "oxoferrite") found by Schenck and Dingman is explained by the presence of Al₂O₃ in solid soln., dissolved from the reaction vessel by Fe₂O₃. The soly. of O₂ in pure Fe is considered small as previously assumed.

A. D.

Influence of graphite separation upon the acid solubility of various cast iron types. PETER BARDENHEUER AND KARL L. ZEYEN. *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Düsseldorf* 11, 247-54(1929); cf. *C. A.* 23, 1091. Cast Fe is more strongly attacked by 1.0 N HCl, H₂SO₄, HNO₃ and HC₂H₃O₂, the finer is its graphite sepn. It makes no difference whether the coarse or fine graphite sepn. is produced by the temp. or condition of the mold, by varying thickness of the casting, or by a non-uniform heating of the melt. The results are in agreement with the theory of local cells, for with fine graphite the no. of particles and therefore the no. of local elements are increased.

H. STOERTZ

The hardness of vacuum-annealed crystals of iron. HUGH O'NEILL. *J. Iron Steel Inst.*, Advance copy No. 8, 27 pp. (Oct., 1929).—Armco Fe strained in tension, then heated in a vacuum furnace at a temp. rising from 765° to 800° in 2 1/4 hrs. and cooled

in vacuo to room temp., was subjected to Brinell tests. The "Meyer analysis" applied to the results showed that n (the hardenability) in the regions of different grain-size in a piece of Armco Fe recrystd. *in vacuo* is variable, but the value of H_u (ultimate Brinell no.) is independent of the grain-size. Fe prep'd. from mild steel by decarburizing in H_2 , straining, annealing in H_2 , polishing, and annealing *in vacuo* have H_u values independent of the grain size and of the orientation in the case of single crystals. Scratch tests were made with a 1-mm. spherical diamond on vacuum-annealed decarburized Fe over a temp. range from -185° to $+170^\circ$ and the changes in hardness studied. "Meyer analysis" of the results suggested that the strain-hardening capacity of the Fe in the form of aggregates or single crystals increases somewhat as the temp. rises. Different directions on crystal faces have distinctly different scratch hardness values. There is a slight increase in scratch hardness of the annealed ferrite aggregate at about 120° .

C. H. LORIG

The solubility of carbide in ferrite. H. A. DICKIE. *J. Iron Steel Inst.*, Advance copy No. 2, 25 pp. (Oct., 1929).—The effects of various elements on the soly. of carbide in ferrite and the form of the soly. curves were det'd. for a wide range of steels, including alloys contg. up to 7% Ni, 2% Mn, 5.5% Cr, 4.5% Ni with 1.5% Cr, and Armco Fe.

Downs Schaaf

The hardening of superhardened steel by magnetism. EDWARD G. HERBERT. *J. Iron Steel Inst.*, Advance copy No. 5, 17 pp. (Oct., 1929).—Exptl. data are given to show that the increase of hardness which is obtained in some steels by annealing at 120° after superhardening by the cloudburst treatment can be brought about by magnetic treatment.

Downs Schaaf

High elastic-limit structural steels. J. A. JONES. *J. Iron Steel Inst.*, Advance copy No. 7, 14 pp. (Oct., 1929). The effect of C, Mn, Si and Ni on the properties of structural steel, in the form of plates and flat bars, was investigated, and it is concluded that the type giving the best phys. properties is that contg. 0.3% C, 1.3% Mn and 0.9% Si. Also in *Engineering* 128, 482-4 (1929).

Downs Schaaf

Study of silicon structural steel. HERBERT BUCHHOLTZ. *Mitt. Forsch. Inst. Ver. Stahlwerke Aktienges. Dortmund* 1, 105-45 (1929). The following steels were investigated: 4 specimens contg. about 1% Si, 0.7% Mn, and from 0.1 to 0.19% C, and 2 specimens of St 48 contg. in the one case 0.32% C, 0.3% Si, 0.7% Mn, and 0.15% Cu, and in the other case 0.24% C, 0.28% Si, 0.8% Mn and 0.27% Cu. Tensile strength, limit of stretch, elastic limit, impact strength, and resistance to corrosion were studied, the results being shown in curves. Conditions of heat treatment have much less effect upon the properties of Si steels than upon those of St 48, while addition of 0.25% Cu to one of these Si steels increases its resistance to corrosion to much greater values than in the case of St 48.

H. STOERTZ

The effect of aging and of "blue-brittleness" on the toughness of low-carbon steel. A. KÜHLE. *Metals and Alloys* 1, 172-5 (1929).

A. J. MONACK

Influence of aging and blue fracture upon fatigue impacts tests. A. KÜHLE. *Mitt. Forsch. Inst. Ver. Stahlwerke Aktienges. Dortmund* 1, 83-102 (1929).—Cold working of steels produces an increase of 45% or more in impact fatigue values, but this increased strength is lost on aging. High grade steels show an increase in impact fatigue tests on annealing at temps. of $300-500^\circ$, but above that, the values fall again. Notch test values fall somewhat in the blue fracture zone ($200-300^\circ$) and then rise again. Notch impact tests on a cold worked steel contg. 0.07% C, 0.39% Mn, 0.09% P and 0.08% S show values under 5 m. kg./sq. cm. for annealing temps. between 100° and 400° . With higher annealing temps. there is an increase in impact strength. Artificial aging gives in general for all materials an increase in impact fatigue strength. If the above sample is given a preliminary impact treatment at $200-300^\circ$ and then tested to fracture at normal temp., an extraordinary brittleness is produced, shown microscopically to be due to recrystn.

H. STOERTZ

The effect of reduction from ingot to forging in steel forgings. LAWFORD H. FRY. *Proc. Am. Soc. Testing Materials* 29, Pt. II (reprint), 11 pp. (1929).—Ingots of forging steel contg. 0.5% C and 0.6% Mn were made by 4 manufacturers; blooms were made from them of half, third and quarter the cross-sectional area of the ingots, resp., and forgings were made from the blooms with reductions in area of 20 to 40%. Extensive testing showed that the amt. of reduction in forging had little effect on yield point or tensile strength, and improved the ductility only up to a reduction of 3 to 1. A larger ingot size involves a less uniform structure, and smaller forgings are more efficiently heat treated and generally not finished so hot; these factors interfere with the direct measurement of the effect of forging. Quality factors, computed as the product of strength times ductility, show little av. variation due to reduction in forging, above

reductions of 3 to 1. Billets purchased for forging should be made from ingots of at least 3 times the cross-sectional area of the billets. GEO. F. COMSTOCK

Inverse segregation in duralumin ingots. S. M. WORONOFF. *Z. Metallkunde* 21, 310-6(1929).—Inverse segregation is found in castings of 99.0-99.5% Al as well as in all Al alloys which form solid solns. upon freezing. This inverse segregation is related to an extended freezing range with the formation of solid solns. and consists in a displacement of the originally solidified crystals with respect to the melt. The compression of the ingot at the moment of crystn. is the chief controlling factor. Variations in compn. on the cross-section of the duralumin ingot is not greatly effective during subsequent working, with the exception of the outermost layers. These outermost layers, however, lead to serious defects in rolled material and must be eliminated. To accomplish this it is recommended that the elements inducing inverse segregation be reduced in amount, that the difference in the freezing of the outer zones and center be diminished by heating of the mold and by a choice of a proper relation between mold size and ingot size and that the evidences of inverse segregation on the surface of the ingot be removed by a scraper before or after the hot rolling. Tables are given showing gross and surface analyses of duralumin ingots, and a single table shows the deleterious effect of "rolled-in" segregation upon the physical properties of age-hardened duralumin. Photomicrographs illustrate various segregation structures. ROBERT F. MEHL

Austenitic steels. ALBERT SAUVEUR. *Fuels and Furnaces* 7, 1365-6(1929).—Austenitic steels offer in comparison with non-austenitic steels the claimed superiorities of: (1) greater resistance to corrosion at room temp., (2) greater resistance to corrosion and to scaling at elevated temps., (3) absence of brittleness at all temps., (4) resistance to heat treatments which injure other steels, (5) greater resistance to "creep" at high temps. and (7) remarkable retention of their strength at elevated temps. The superiority of strength increases rapidly with temp. increase. W. H. BOYNTON

Ferromanganese. K. TH. KÜRTEN. *Zentr. Hütten- u. Walzwerke* 32, 193-7, 216-8; *Chem. Zentr.* 1928, I, 2867.—At least 90% of the world's Mn is used in Fe works. Ferromanganese contains 25-80% of Mn. The blast furnace and elec. furnace operation for Mn steels is described. Ferromanganese has an increasing C content with an increasing Mn content up to 7.5%. The max Si content is 1.0%; P is 0.2-0.25.

C. R. FELLERS

Report of research committee on the effect of tin and arsenic on high-speed tool steel. N. B. HOFFMAN. *Proc. Am. Soc. Testing Materials* 29, Pt. 1 (reprint), 5 pp. (1929).—The contents of WO_3 , As and Sn in W ores from various deposits are given, some ores contg. over 3% As and up to 7% Sn. A heat of high speed steel was made with 0.445% Sn, and another with 0.51% As, and both were worked into bars in the usual way. The ingots flowed less readily under the hammer than normal high-speed steel and the bars were more brittle when annealed, though the Brinell hardness was normal. The cutting properties were noticeably impaired by the As and Sn. In crucible melting the loss of Sn was 28.8% and of As 18.4%.

GEO. F. COMSTOCK

Influence of atmospheres on the heat treatment of steel. R. G. GUTHRIE. *Fuels and Furnaces* 7, 1345-54(1929); cf. *C. A.* 23, 3648.—Time, temp., pressure, type of steel and the velocity and vol. of a given gas over the material are important factors in carburization. A general discussion and numerous photomicrographs are shown.

W. H. BOYNTON

The heat-treatment of alloy steels. W. H. HATFIELD. *Fuels and Furnaces* 7, 1355-60(1929).—A discussion of the general aspects of the problem of treating alloy steels. "Adequate furnaces, quenching baths and mech. means of efficient handling of the product, accurate detn. of the temp. of the part being treated, complete knowledge of the metallography of the steel being treated, time-temp. effect and speed of cooling to be made as regards the influence of mass and adequate means of testing the final product are the essential aspects in the heat treatment of alloy steels." W. H. B.

The binary systems: iron-boron, iron-beryllium and iron-aluminum. FRANZ WEVER and ANTON MÜLLER. *Mitt. Kaiser-Wilhelm-Inst. Eisenforsch. Düsseldorf* 11, 193-223(1929).—The equil. diagram of Fe-B was studied thermally, microscopically and by means of x-rays, and was found to belong to that group of binary Fe alloy having a narrowly limited γ -phase. As a result of insufficient soly. a closed γ -field was not obtained. Mixed crystals of α -Fe-B as well as the solid soln. γ -Fe-B are formed by ordinary atomic substitution. The boride Fe_4B_3 has a tetragonal space lattice with 2 mols. per unit, while the boride FeB also exhibits tetragonal symmetry with 16 mols. per unit. The Fe side of the equil. diagrams of Fe-B and Fe-Al was studied and both systems were found to have completely closed γ -fields. Mixed crystals of α -Fe and γ -Fe with both Be and Al are formed by atomic substitution. H. STROETZ

Ternary diagrams with iron-carbon as a basis. ERICH SCHELL. *Mitt. Forsch. Inst. Ver. Stahlwerke Aktienges. Dortmund* 1, 1-12(1928).—The ternary systems of Fe and C with Mn, Ni, Si, P, Cr and S were studied and equil. diagrams shown. The occurrence of unstable phases and their relation to stable forms were studied. Fe-Mn-C and Fe-Ni-C have diagrams without closed γ -fields. Where there is a closed γ -field in binary Fe-X diagrams, the ternary diagram with C shows a 4-phase equil. $\alpha + \gamma + S + Fe_3C(C)$. The location of this 4-phase "surface" in the diagrams Fe-Si-C, Fe-P-C and Fe-Cr-C was detd.

H. STOERTZ
Progress in alloys of iron research. FRANCIS M. WALTERS, JR. *Mining Met.* 10, 418-9(1929).—A high-frequency induction furnace for making Fe-Mn alloys in an atm. of A is described and illustrated.

DOWNES SCHAAP
Alloys of beryllium with iron. W. KROLL. *Metallwirtschaft* 8, 881-3(1929).—Fe-Be alloys show the same type of aging phenomena as is obtained with duralumin. Addn. of Ni improves binary Fe-Be alloys, giving an extremely fine grain size and reducing the amt. of Be required. Fe alloys contg. Cr as well as Be and Ni show very fine mech. properties and greater resistance to corrosion than 12% Cr steel. A steel contg. 20% Cr, 7% Ni and 1% Be gives a Brinell no. of 480 (3000-10-1) and has properties similar to high-speed tool steels.

H. STOERTZ
Stability of hysteresis in iron-nickel alloys. G. GOSSELS. *Z. anorg. allgem. Chem.* 182, 19-27(1929).—Resistance isotherms are measured and plotted for 0-46% Ni from 0° to 900°. The alloy contg. 33.2% Ni shows the max. resistance of 132×10^{-4} ohms at 900°. Expts. in which alloys were heated for 5 hrs. at elevated temps. (500-700°) show that the hysteresis zone persists even at high temps.

H. STOERTZ
Heat-resisting alloys and their use in the steel plant. J. D. CORFIELD. *Iron and Steel Eng.* 6, 157-62(1929).—A general discussion of Ni-Cr and Cr-Fe alloys, the design of castings and structures intended for use at elevated temps. General uses for heat-resisting alloys include: (1) wherever metals must serve under temps. high enough to cause replacement of iron or steel due to surface losses through oxidation or corrosion; (2) wherever loads must be supported under temps. for long periods of time; (3) wherever loads must be supported and surface losses reduced to a min.; and (4) wherever abrasion is present at high temps. Specific applications are named, particularly in the steel plant. A discussion is included.

W. H. BOYNTON
A ferro-alloy used in a plant for the preparation of synthetic ammonia. M. RAFFO. *Met. ital.* 21, 213-9(1929).—An alloy contg. C 0.35, Cr 10.80, Ni 58.1, Fe 30% (Mn = 2%) has been used for tubings in an NH_3 -mfg. plant. After 50 hrs. cracks appeared due to attack of the gases, where crystn. was starting. A less expensive alloy would be equally satisfactory providing the material was homogeneous.

A. W. CONTIERI
Aluminum alloys for pressure die castings. S. TOUR. *Metals and Alloys* 1, 176 (1929).—See C. A. 23, 4179.

A. J. MONACK
Pinholes in cast aluminum alloys. N. F. BUDGEN. *J. Inst. Metals*, Advance copy No. 501, 14 pp.(1929).—The influence of the Al ingot itself, the melting and pouring temps., the time maintained molten, the melting fuel and furnace, the rate of solidification, the turbulence of pouring and the alloying elements, are separately considered in relation to their effect on pinholing in cast Al alloys. Also in *Engineering* 128, 452-4(1929).

DOWNES SCHAAP
Chrome-nickel stainless alloys. T. HOLLAND NELSON. *Iron Age* 124, 887-90 (1929); cf. C. A. 23, 3200, 3887.—Alloys contg. about 18% Cr and 8% Ni can be welded more easily than chrome-Fe, have a wider temp. range within which they can be forged or rolled, and so far have shown less tendency to embrittlement due to prolonged heating at 455-565°. N. attributes the corrosion-resisting properties of these alloys to their Cr content and their ease of fabrication to Ni.

R. E. SCHAAD
Physical and chemical properties of alloys based upon cobalt-chromium-tungsten. K. LÖNNBECK. *Mitt. Forsch. Inst. Ver. Stahlwerke Aktienges. Dortmund* 1, 65-82 (1929).—A study of such com. high-speed cutting alloys as *stellite* and *akrit*. The influence of variation in C, W, Cr and Ni content as well as heat treatment was investigated and included effect upon hardness, as well as resistance to corrosion. The influence of C is greatest and the alloy most inert to chem. attack has the compn. 55% Co, 28% Cr, 15% W and 2% C.

H. STOERTZ
The creep of 80:20 nickel-chromium alloy at high temperatures. A. GLYNNE LOBLEY AND C. L. BETTS. *J. Inst. Metals*, Advance copy No. 506, 20 pp.; *Engineering* 128, 422-4(1929).—The effects of temp., stress, sectional area and time on the rate and the magnitude of creep were studied for a Ni-Cr alloy contg. 80% Ni and 20% Cr, by subjecting wires of different diams. to tensile stresses at different temps.

DOWNES SCHAAP

"Elektron" a new alloy, and its industrial applications. ANDREA W. BONARETTI. *Met. ital.* 21, 174-86 (1929).—"Elektron" is a name given to a large group of alloys having the approximate compn.: Mg = 90.5%, Al = 6%, Zn = 3%, Mn = 0.5%. They are characterized by their lightness (sp. gr. = 1.75-1.85), high modulus (4000-5000 kg./sq. mm.), thermal cond. ($\frac{1}{3}$ that of copper), and high elec. cond., making them promising in aeronautics, automobile, telephone, machinery and naval construction.

A. W. CONTIERI

The structure of gold-nickel alloys. W. HEIKE AND H. KESSNER. *Z. anorg. allgem. Chem.* 182, 272-80 (1929).—Hafner's view that in Au-Ni alloys, a Au-rich mixed crystal undergoes a eutectoid decompn. is confirmed by microscopic investigation. By long heating of Ni-rich alloys (21 days at 750° and 37 days at 550°) a complete change of structure takes place. Many radially arranged globular colonies were found in an alloy contg. 40% Ni, which resembled eutectic structures such as found in slowly cooled Cu-Ag alloys. The significance of this structure is to be detd. by further work. A hot K₂S soln. is the best etching agent for Au-rich Au-Ni alloys.

H. STOERTZ

Determination of nickel in aluminum alloys. R. O. JOHNSON. *Chemist-Analyst* 18, No. 4, 14 (1929).—Treat the alloy with 150 cc. of 5.3% KOH, filter and det. the Ni in the residue by the dimethylglyoxime method.

W. T. H.

Lead, antimony and tin-base bearing metals. H. MÜLLER. *Z. Metallkunde* 21, 305-9 (1929).—The effects of the addn. of Cu and Ni to alloys of Pb, Sb and Sn were investigated with the object of producing satisfactory bearing metals cheaper than the ordinary Sn-base alloys. Alloy structures found are illustrated by photomicrographs and are discussed in relation to the constitutional diagrams. This paper is a more complete account of previously published work (*C. A.* 23, 4430).

R. F. M.

Segregation in certain non-ferrous alloys. ROBERT LAW. *Proc. Soc. Chem. Ind. Victoria* 27, 1414-31 (1927).—Segregation in certain Ag-Cu, Au-Pb, Au-As and standard gold alloys is discussed. In Cu-Ag alloys contg. more than 71.8% Ag, more Cu is found on the outside than the known av. contents of the mass; for alloys contg. 71.8% Ag the compn. is const. throughout; and for those with less than 71.8% Ag, more Ag is found on the outside than the av. contents of the mass. At one stage in the cooling of the liquid metal, there is one constituent common to each of these 3 cases, viz., the eutectic or last liquid portion. If this moves, or is forced outwards, all the facts are accounted for. Theories of segregation are discussed, and the knowledge of behavior of alloys on cooling is shown to be important in taking true samples.

W. C. F.

The effect of the so-called Utah shale "fluxes" on the dispersion of lead in copper-lead alloys. G. L. CRAIG. *Metals and Alloys* 1, 162-5 (1929).—Utah shales and similar materials have been suggested as fluxes for use in melting metals. It has been claimed that such materials will produce homogeneous, disseminated mixts. of Cu and Pb. C. has attempted the study of this assumed action. The shales used are typical carbonaceous shales. The compns. of 2 of them (shale A and B) are, resp.: SiO₂ 45.71, 63.02; Al₂O₃ 14.85, 15.72; Fe₂O₃ 5.50, 3.45; TiO₂ 0.58, 0.91; CaO 0.81, 0.34; MgO 0.45, 1.21; K₂O 1.05, 2.00; Na₂O 0.24, 1.09; ignition loss 30.76, 11.13. Pure Cu was melted in plumbago crucibles, brought to a temp. of 1120°, pure Pb was added and the temp. was allowed to drop to 1000°. The melt was stirred during cooling. Chill, green sand and dry sand molds were used for the castings. The castings were allowed to remain in the molds for varying times to det. the effect of time of cooling on av. particle size. Samples were quenched in H₂O and in air. Heats were made with (1) all of the shale added with the Cu, (2) all with the Pb, (3) after addn. of the Pb, when the whole charge was completely liquefied, (4) half with the Cu at the start and half with the Pb. Shales A and B were used. Specimens were taken from castings for microscopical examn. Particle counts were made to det. the disseminating action of the shales. The results are shown graphically. There is no indication that an increased dispersion was obtained by the use of shale fluxes and the latter are without effect upon the distribution of Pb particles in Cu-Pb mixts. No beneficial effect of the shale was noted in any respect.

A. J. MONACK

Influence of a third metal upon the constitution of brass alloys. I. The influence of lead. O. BAUER AND M. HANSEN. *Z. Metallkunde* 21, 145-51 (1929).—The authors review the work of other investigators upon brass alloys, and declare that Guillet's "equivalency coefficients" can no longer be regarded as adequate in predicting the structure of these alloys. Pb-Zn-Cu alloys are prepd. with a range of 1-5% Pb, 23-40% Zn, and cooling curves are detd. from about 980°. The equil. diagram is shown in detail for these alloys with a const. Pb content of 2%. It is characterized by a horizontal at 886°, which comprises a large concn. range (about 60 to 67% Cu) and represents the

4-phase reaction $\alpha + S_{Cu} \longrightarrow \beta + S_{Pb}$, in which S_{Cu} is the Cu-rich melt and S_{Pb} is the Pb-rich melt.

H. STROERTZ

The influence of a third metal upon the constitution of the brasses. I. The influence of lead. O. BAUER AND M. HANSEN. *Z. Metallkunde* 21, 190-1 (1929); cf. preceding abstr.—The ternary system Pb-Zn-Cu was investigated in the range 100-52% Cu and 0.0-2.5% Pb, by thermal and microscopical methods, and a section of the ternary diagram for a const. Pb content of 2% and several sections for const. Cu contents of 80, 64, 58 and 54 were worked out. The solidification of the ternary alloys is analogous to the freezing of the binary alloys of Cu-Pb. The Cu-rich melts with more than 67% Cu sep. according to the relation $melt_{Cu} \longrightarrow \alpha + melt_{Pb}$. The sepn. of the melts pptg β by primary crystn. takes place a few degrees below the temp. of initial freezing and is completed in a very narrow temp. interval, $melt_{Cu} \longrightarrow \beta + melt_{Pb}$. In the concn. range of the peritectic reaction $\alpha + melt \rightleftharpoons \beta$ there occurs a combination of the two three-phase equil. $\alpha + melt \rightleftharpoons \beta$ (at 905° in the Cu-Zn system) and $melt_{Cu} \rightleftharpoons \alpha + melt_{Pb}$ (at 954° in Cu-Pb system) to the four-phase equil. $\alpha + melt_{Cu} \rightleftharpoons \alpha\beta + melt_{Pb}$ at 886°. The end of the freezing in all the alloys lies at 886°. The structure of the alloys after complete sepn. is conditioned by the "practical" insolv. of the liquid and solid Pb in α - and β -crystals. 0.1% Pb can be recognized in all alloys after heating at different temps. and cooling slowly to room temp. This Pb content lies at the limit of microscopic visibility. Under the assumption of an equal Cu content of the two- and three-phase alloys, the $\alpha(\alpha + \beta)$ - and $\beta(\alpha + \beta)$ soly. (limiting) curves of the Cu-Zn system were found to be displaced by Pb addns. to higher temps., but binary and ternary alloys with the same relation of the Cu content to the Pb content have the same temps. of transition. The isothermal limiting curves are straight lines passing through the m. p. of Pb. The paper is accompanied by numerous photomicrographs and constitution diagrams. R. F. M.

Melts various alloys in gas-fired furnaces. J. B. NEALEY. *Foundry* 57, 821-2 (1929)

R. J. C.

The causes of cuppy wire. W. E. REMMERS. *Am Inst Mining Met Eng. Tech. Pub. No. 237*, 12 pp. (1929). A bibliography is given, various causes being cited by previous investigators. Cuppiness of wire was detected most sensitively by examg. a tensile fracture, but metallographic methods were also used. The effects of die contour, reduction per die, lubrication and O content up to 0.130% were studied. A pantographic method for sketching the die contour is described. The tendency toward cuppiness increased as the angularity of the die increased and as the radius of curvature decreased. Smaller reductions per die favored cuppiness, as did also reversing the direction of drawing and higher O content. A definite relation is shown between O in the Cu and the die angle producing cuppiness, a larger angle being permissible without cuppiness if the O is low.

GEO. F. COMSTOCK

Deoxidation of copper with calcium and properties of some copper-calcium alloys. EARLE E. SCHUMACHER, W. C. ELLIS AND JOHN F. ECKEL. *Am Inst. Mining Met. Eng. Tech. Pub. No. 240*, 13 pp. (1929). Alloys of Cu contg. 0.05 to 0.8% Ca were made, and all except the one with 0.8% Ca were ductile and could be drawn into wire. The strength and hardness were slightly increased, and the ductility was decreased, by increasing Ca. The cond. of the Cu was decreased only 1% by each 0.05% of Ca content. The practicability of deoxidation by Ca was demonstrated. The Ca-Cu eutectic contains 5.8% Ca and m. 910°. $CuCu_4$ has no solid soly. in Cu. Hence deoxidized Cu of high cond. may be obtained by adding Ca. G. F. C.

Properties of locomotive firebox stays and plates. O. F. HUDSON, T. M. HERBERT, F. E. BALL AND E. H. BUCKNALL. *J. Inst. Metals*, Advance copy No. 505, 80 pp. (1929). The conditions existing in a locomotive firebox are studied and the results are given of an investigation of the oxidation of arsenical Cu in firebox atms., the properties of the oxide scale formed and the action of the leakage liquid. Small percentages of other metals were added to Cu to det. their effect on the softening and elastic properties of the metal under service conditions.

DOWNES SCHAAF

Effect of heat treatment on properties and microstructure of Britannia metal. R. EGBERG AND H. B. SMITH. *Am. Inst. Mining Met. Eng., Tech. Pub. No. 244*, 14 pp. (1929). Further study of the phys. properties of Britannia metal (cf. C. A. 22, 3611), consisting of tensile, bend and deep drawing tests, along with a metallographic study of the metal, enabled the authors to give an explanation for the abnormal behavior of this alloy.

DOWNES SCHAAF

Effect of filling materials upon aluminum tubes. JOSEF AUGUSTIN. *Chem.-Ztg.* 53, 692 (1929).—Tubes of purer Al used nowadays are better than the older ones, with Al alloys as a base, for holding com. products. Extensive tests have shown that neutral

materials only should be packed in such tubes; even weak acids and alkalis cause corrosion. For such materials protective linings in the tubes must be employed.

W. C. EBAUGH

Investigations on the behavior of various materials in hot brines. SPANNER AND GOLTERMANN. *Kali* 23, 260-2(1929).—With hard Pb insufficient hardness means low resistance. No adhering, protective layer forms. V₂A metal failed from combined corrosion and erosion. Hair cracks and porous spots were very troublesome. V₂A gave local corrosion. Sn bronze suffered from mech. erosion because of low hardness. Zn bronze and P bronze were similar. Monel and rotoxit (Cu-Si) were better. A 4% Al bronze is suitable, but not Pb and Sb bronzes. C steel or gray or perlite cast Fe are rather satisfactory, corrode uniformly, and can be hardened. An 8% Si-Fe casting is very good.

E. M. SYMMES

Metal spraying. LEOPOLD PESSEL. *Chemist-Analyst* 18, No. 4, 4-5(1929).—A short survey is given of the metallurgical and chemical aspects of spraying thin coatings of Zn, Cd, Al, Mg, Sn, Pb, Cu, etc.

W. T. H.

Can lead corrode? K. SCHERINGA. *Pharm. Weekblad* 66, 741-3(1929).—Pb has been considered rustproof in consequence of the supposed formation of a superficial layer of suboxide. Specimens of Pb roofing and water piping, however, were found which showed deep corrosion with formation of a white or reddish yellow crust. The metal corrodes more rapidly when it is in contact with lime or cement. An oxidation occurs in the presence of air and a base such as lime or caustic alkali. Under these conditions the remaining metal becomes more active, possibly by recrystn., so that it dissolved readily in 50% HNO₃, whereas recently melted Pb is passive. The oxidation is catalyzed by the presence of PbO. A 2-g. sample of Pb powder after rubbing with PbO gained 11 mg. in wt. in 24 hrs.

A. W. DOX

Corrosion-testing apparatus. D. F. OTHMER. *Ind. Eng. Chem., Anal. Ed.* 1, 209 (1929).—Corrosion of metals is tested in a glass column packed with glass beads, through which the vapor of the corrosive agent is passed from a boiling flask. Metallic salts are thus washed off, and conditions for test are more nearly reproducible.

C. Z. ROSECRANS

The prevention of corrosion. E. S. STOKES. *Chem. Eng. Mining Rev.* 21, 432-40 (1929).—A review.

H. C. PARISH

Corona on aluminum conductors as affected by corrosion due to atmospheric exposure. ERNEST WILSON. *Trans. Faraday Soc.* 25, 496-502(1929).—Pure Al wires exposed for 8 and 23 years were compared with themselves and with a 0.75% Ni alloy wire exposed 24 years by studying their corona discharges. The uncorroded Ni alloy gave discharges characteristic of a smooth wire while the pure Al wires gave irregular discharges characteristic of a rough surface.

MALCOLM DOLE

The corrosion of brass. MAX HAAS. *Metals and Alloys* 1, 183-9(1929).—See C. A. 23, 2686.

A. J. MONACK

Electric welding of field joints of oil and gas pipe lines. HAROLD C. PRICE. *Am. Mining Met. Eng., Tech. Pub.* No. 251, 17 pp.(1929)

E. J. C.

Improving manufactured objects of aluminum and its alloys by means of soldering and welding. H. REININGER. *Metallhørse* 19, 1713-4, 1770-1, 1883-4, 1993-4, 2106-8 (1929).—Soft-soldering takes place between 200° and 400°, with Zn- or Zn-rich alloys; the solder is wiped or rubbed into place, and no flux is employed. Hard-soldering occurs at 400° to 600°, depending upon the m. p. of the solder; a flux is used. For successful soldering there must be a tendency for the solder or its chief constituent to form mixed crystals or solid solns. with the Al itself, otherwise only slight adhesion occurs, rather than cohesion. In welding, the same kind of metal as the part to be repaired is used, and uniform compn. is therefore obtained. Either gas or elec. welding may be employed, or molten metal Al, at 680° to 750°, is poured over the break. Working temps. for welding lie between 650° and 800°. Welding by hammer or pressure occurs at 400-500°, as Al and its alloys are plastic at these temps. Soft-soldered parts do not have the high tensile strength, etc., of welded places. In general, the working properties (machining, etc.) of repaired places are as good as other parts, except where oxides have been included. Soft-soldered portions show greater liability to corrosion, because of the large p. d. between Al and Zn. Welded parts are heat resistant to the same degree as Al itself, hard-soldered about 150° less, and soft-soldered least of all. Coloration of welded and hard-soldered portions are also better than those repaired with soft solder. Photomicrographs and tables show properties of different types of repairs, the effects of homogenizing or tempering under varying conditions, etc. Unfortunately with long-continued heat treatment comes also the development of oxide inclusions, with lowering of tensile strength and toughness. In solders Pb

and Bi are used to the extent of only 3%, and Cd, 5%; Zn amounts to as much as 90%, with Al, Cu and Sn making up most of the remainder. Sn-rich solders may contain 80% Sn, with Al, Zn and Cu; they flow better than the Zn solders. Hard solders may contain Al up to 80%, with a little Cu and either Sn or Zn to lower the m. p. Metal for welding is best obtained from pieces of the same compn. as the piece to be repaired. As fluxes mixts. of chlorides and fluorides of Na, Li, K, Mg, Zn, Ca and Ba are employed. As minor ingredients are used NaKSO_4 , $\text{Na}_2\text{B}_2\text{O}_7$, and sometimes cryolite and carbonates of Na and K. The m. p. of a good flux should lie about 30° below that of the solder or metal with which it is to be used.

W. C. EBAUGH

British water pipe practice and experience (BAKER) 14. Reducing corrosion (DAY) 14. Corrosion-resistant materials used in Germany in the manufacture of chemical apparatus (KLIMOV) 1. Analytical recognition of the metal-corroding power of papers (KALB, VON FALKENHAUSEN) 23. Corrosion-resistant steels for the paper industry (MATTHEWS) 23. Welded pulp digesters (JASPER) 23. Metals for dairy machinery (McDOWALL) 12. Cast iron and steel [as water-pipe materials] (SAVILLE) 14. X-ray analysis of the Cu-Sb and Ag-Sb systems (WESTGREN, *et al.*) 2. An x-ray investigation of the Au-Hg system (PABST) 2. A dilatometric study of some univariant 2-phase reactions [thermal transformations in alloys] (CHEVENARD, *et al.*) 2. Chemical properties of metals ((DESCH) 2. Partial molal heat capacities and relative partial molal heat functions in solutions of molten metals (GUTHRIE, LIBMAN) 2. Experimental foundations of the passivity theory (MÜLLER) (HINNÜBER) 2. Blast-furnace gas cleaning (HEDBERG) 4. Immersion burner apparatus for direct heating of molten Pb or other metals, ores, etc. (U. S. pat. 1,730,440) 1. A supply tank and burner pipe construction, etc., for use in opening tap holes of open-hearth furnaces, etc. (U. S. pat. 1,730,678) 1. Benzyl mercaptans, etc., for mineral flotation separation, etc. (U. S. pat. 1,729,615) 10.

Desulfurizing ores. CHARLES L. LEVERMORE (to General Chemical Co.). U. S. 1,730,738, Oct. 8. Finely divided sulfide ore contg. less than 0.3% moisture is roasted in gaseous suspension.

Roasting iron carbonate ores. ANTON APOLD and HANS FLEISSNER. U. S. 1,729,697, Oct. 1. The ore is decomposed by heating with hot oxidizing gases and treated with addnl. quantities of CO_2 -free O-contg. gas such as air or steam rapidly to displace the CO_2 liberated from the ore and further to oxidize the iron to higher oxides.

Smelting lead ores in a hearth-type furnace. HUGH R. MACMICHAEL (to American Smelting and Refining Co.). U. S. 1,730,582, Oct. 8. A suitable mixt. of ore and fuel is fed to a hearth and combustion-supporting gases are passed through the mixt. to maintain the mass at a temp. above the m. p. of Pb but below its volatilizing point; the surface of the mixt. is broken up and reformed with a comparatively steep slope and sufficient momentum is imparted to the ore particles to cause the larger particles to sep. from the finer particles and to roll toward the lower side. App. is described.

Reclaiming light readily oxidizable metals from scrap. THERON D. STAY (to Aluminum Co. of America). U. S. 1,729,631, Oct. 1. In reclaiming metals such as Al from finely divided scrap metal, the scrap is freed from particles of iron, added to a molten bath of metal of the kind to be reclaimed in which there are upward and downward circulating currents and quickly immersed in the molten bath; the circulating currents are continued and impurities collect as dross on the surface of the bath; the dross is heated and removed, and substantially all the molten metal entrapped in the dross is immediately sepd. and agglomerated (suitably by disintegration, cooling and screening). Cf. C. A. 22, 3621.

Recovering metal values from materials such as smelter slags. HARRY V. WELCH (to International Precipitation Co.). U. S. 1,730,548, Oct. 8. A mixt. of air, powdered coal or other suitable fuel and a halidizing agent such as NaCl or CaCl_2 is introduced beneath the surface of a molten body of material such as a smelter slag under treatment to cause combustion of the fuel in direct contact with the treated material with production and volatilization of a halide of Cu or other metal to be recovered, and the volatilized halide is removed and recovered by condensation. An arrangement of app. is described.

Recovery of zinc, lead, copper and silver or other metals from ores. RALPH F. MEYER (to Meyer Mineral Sepn. Co.). U. S. 1,730,584, Oct. 8. Ore contg. a "reagent metal" such as Fe, Cu, Ni or Mn is continuously roasted and the roasted ore is advanced progressively while maintaining it at an elevated temp. but below the decompn. temp.

of the sulfate of the "reagent metal"; NaCl is added progressively as the roasted body advances, and the ore is alternately subjected to the action of air and water vapor, and to air, water vapor and SO₂ and metal values are subsequently extd. from the treated ore.

Freeing copper from copper oxide. HIRAM S. LUKENS and RUSSELL P. HEUER. U. S. 1,730,775, Oct. 8. In removing Cu oxide from molten Cu continuously, the molten Cu bath is covered with slag capable of dissolving the oxide from the Cu, a portion of the slag with its oxide content is removed, and fresh slag is supplied for maintaining the efficiency and continuity of the process. A tilting elec furnace for the process is described.

Molds for casting molten metals. HERBERT C. BUGHARD (to S. D. Warren Co.). U. S. 1,730,801, Oct. 8. The surfaces of molds such as those formed of molding sand are dusted with a powder contg. an alk. earth metal carbonate individually carrying a pptd. coating pptd. on them by treatment with oleic acid or a similar material.

Feeder for ingot molds. ANDREW R. ROWE. U. S. 1,730,384, Oct. 8. Structural features.

Casting metals of different hardness and contractive properties together. CERROI, E. REINHARDT. U. S. 1,731,060, Oct. 8. In casting articles such as railway car wheels, different metals such as alloy steel and mild steel are poured into a rigid mold having obstructions to natural contraction, with a septum which may be formed of fusible metal between them and pressure is applied to the metals and septum to cause the metal of greater contractive property to follow the shrinkage of the metal of less contractive-ness. Structural features are described.

Casting ornamental articles such as jewelry. EMILE LIEBERT. U. S. 1,731,169, Oct. 8. Mech. features.

Apparatus for tempering castings such as manganese steel car wheels. JAMES C. DAVIS. U. S. 1,730,918, Oct. 8. Tempering fluid is applied to the periphery of the castings and the app. is arranged to limit the range of application of the tempering fluid to the edges of the peripheral surface of the casting, so that proper differential hardening to equalize wear is effected.

Composite cast iron, steel and copper castings. CHARLES M. WALKER (one-half to Robert L. McElroy and John E. Shepherd). U. S. 1,729,848, Oct. 1. A reinforcing steel rod is electrolytically coated with a thin coat of Cu to serve as a bond between the steel and cast iron, the rod is immersed in a borax soln. flux, allowed to dry, placed in a mold and cast iron is poured around it to form a composite product in which the Cu layer serves as an alloying and bonding material.

Puddling iron. JOHN B. SCHLOSSBERG (to American Chain Co.). U. S. 1,730,014, Oct. 1. A stock of various grades of ferrous metal scrap including iron scrap and steel scrap and which may contain undetd. quantities of P, Si, Mn and C is melted in quantity sufficient to constitute a plurality of charges of molten metal for one or more puddling furnaces. Samples of the molten metal are withdrawn from time to time and analyzed to ascertain the compn. of the metal with respect to P, Si, Mn and C and the molten stock is treated to maintain the content of these elements within desired limits. Molten stock is withdrawn from time to time, from the main supply, for charging one or more puddling furnaces, and the supply is made up with addnl. charging materials, to maintain the continuity of the process. Puddling is effected in furnaces of the oscillating or rotary type.

Purifying pig iron. FRITZ WÜST. U. S. 1,730,960, Oct. 8. A pig iron soln. rich in P and S is caused to react on a lime iron-ore slag, already somewhat exhausted until it is entirely exhausted, at such a temp. that the C content is not substantially diminished; the exhausted slag is tapped and it is replaced by a fresh lime iron-ore slag which effects further removal of P and S from the molten pig iron; the purified metal is then tapped and is replaced by a further quantity of pig iron to be purified.

Apparatus for withdrawing gases from the interior of blast furnaces. JOHN W. WALTON (to Tennessee Products Corp.). U. S. 1,729,973, Oct. 1. Structural features.

Bearing metal alloy. KARL MÜLLER and WILHELM SANDER. U. S. 1,731,021, Oct. 8. Alloys are described contg. Pb 70-75, Sb 15-25, Sn 3-6, a metal of the Co type about 1-3, Cu 0.6-2.0 and not exceeding 1% of metals of the Fe group. Cf. C. A. 23, 593.

Gold alloys. VICTOR D. DAVIGNON (to General Plate Co.). U. S. 1,731,210, Oct. 8. A homogeneous malleable and ductile alloy suitable for jewelry, etc., comprises Au about 58, Cu 8, Mg 3, Zn 5% and the remainder Ag. U. S. 1,731,211 specifies an alloy contg. Au about 50, Si 1-3, Mn 1% and the remainder Cu, and which is of relatively low sp. gr. U. S. 1,731,212 specifies Au 25-85, substantial quantities of metal of the

group comprising Si and Ti up to 3%, Al up to 3%, a small but substantial quantity of Mn (suitably about 1%) and the remainder Ag. U. S. 1,731,213 specifies Au 25–85, Ti in substantial quantity up to 3%, and the remainder mainly Cu.

Ruthenium alloy. MELVIN M. GOLDSMITH and WM. H. FALCK (Falck to Goldsmith Bros. Smelting & Refining Co.). U. S. 1,730,003, Oct. 1. An alloy suitable for use as a substitute for osmiridium for pen points comprises Ru about 75, W about 17.5 and Ni about 7.5%. Some similar alloys also are described.

Alloy steel. FREDERICK F. MCINTOSH (to Crucible Steel Co. of America). U. S. 1,730,780, Oct. 8. A stainless alloy steel contains C 0.1–1.0, Cr 8–18, Mn 0.9–1.3, P 0.08–0.15 and S 0.05–0.15%.

Case-hardening. GUSTAV W. SCHWAB and FREDERICK J. SCHWEIZER, JR. U. S. 1,730,247, Oct. 1. An "excessively carbonous" gas is preheated and its carbonaceous constituents are reduced by the heating, and the gas is then used for carburizing articles of iron or steel. An app. is described.

Magnetic testing system for determining the physical properties of drills, lathe tools, hack saws or other magnetizable objects. CHARLES W. BURROWS (to Magnetic Analysis Corp.). U. S. 1,730,966, Oct. 8.

Welding metals such as copper strands. NATHAN H. ADAMS (to General Electric Co.). U. S. 1,730,443, Oct. 8. Prior to welding together surfaces of metals such as Cu strands of elec. conductors, there is introduced between the surfaces a more easily fusible metal (such as an alloy of Pb 90 and Sn 10%) having a slight alloying affinity for the surfaces, and the surfaces are pressed into contact at a temp. materially above the m. p. of the more easily fusible metal and with a pressure sufficiently high to eliminate largely the easily fusible metal.

10—ORGANIC CHEMISTRY

CHAS. A. ROUILLER AND CLARENCE J. WEST

Glimpses of the life of Kekulé in Bonn. A. BERNTHSEN. *Z. angew. Chem.* **42**, 891–2 (1929). E. M. SYMMES

Memorial address on August Kekulé. HEINRICH WIELAND. *Z. angew. Chem.* **42**, 901–4 (1929). — Two portraits. E. J. C.

Commission on the reform of the nomenclature of organic chemistry. A. F. HOLLEMAN. *Rec. trav. chim.* **48**, 641–51 (1929). Report of the chairman of the Comité de Travail, with amendments by the Commission (made at the Hague meeting of the I.U.P.A.C.), comprising 69 rules. [It is expected that the report will be further considered at the Liège meeting in 1930. ANSTR.] AUSTIN M. PATTERSON

The riddle of benzene. August Kekulé 1829–1896. HENRY E. ARMSTRONG. *Chemistry & Industry* **48**, 914–8 (1929). E. J. C.

The production of anhydrous alcohol and its uses. K. PETRÍK. *Chem. Listy* **23**, 431–5 (1929); cf. *C. A.* **23**, 4599. — A review of the industry. FRANK MARESH

Constitution of hydrogen sulfite compounds of aldehydes and ketones. O. STIELING. *Cellulosechemie* **9**, 100–2 (1928). — The absorption band of HCHO and Me₂CO bisulfite compds. is at 4992.0 X, that of sulfonic acids at 4992.2, while that of the metal alkyl sulfites is at 4996.0 and of the dialkyl sulfites at 4997.7 X. It is concluded that the bisulfite compds. have the constitution R₂RC(OH) SO₃Na. A crit. review of the literature is given. B. C. A.

The chemistry of pectins from fruit. FELIX EHRLICH and ALFRED KOSMAHL, *Biochem. Z.* **212**, 162–239 (1929). — Pectin from the orange peels consists of 4 mols. galacturonic acid, 2 mols. MeOH, 2 mols. AcOH and one mol. each of arabinose and galactose. On the further assumption that the pectic acid is formed with a loss of 9 mols. H₂O it should be ascribed the formula C₄₁H₆₀O₂₄. The pectic acid of the orange peel like that of the sugar beet can yield upon mild hydrolysis with 5% HCl the 3 tetragalacturonic acid complexes which are chemically and physically identical ([α]_D = 42.7, +286° and +240°, resp.). A detailed study was also made on the hydrate-pectin of Johannis berries and strawberries, which is shown to be a mixt. of araban and the Ca Mg salts of pectic acid. S. MORGULIS

Some acetylene derivatives of terpenes. Preparation of some dialkylethynylcarbinols. E. BARBE. *Bull. inst. pin* 1929, 245–9. — Methylheptenone, prepd. via Verley by refluxing 12 hrs. with K₂CO₃, steam distg. and rectifying, on treating with sodamide and then with C₂H₂, gave 30% of theoretical yield of dehydrolinalool, C₁₀H₁₆O, b₇₆₀ 194°, b₁₁ 95°, d₂₀ 0.870, n_D²⁰ 1.4615, mol. refraction 47.88 (calcd. 47.83),

gives a ppt. with ammoniacal Cu_2Cl_2 and with AgNO_3 but not with HgCl_2 . Treatment of natural Japanese camphor with sodamide and then with C_2H_2 gives *ethinylborneol*, $\text{C}_{12}\text{H}_{18}\text{O}$, which decomps. at relatively low temp., even in vacuum, and must be sepd. from its Et_2O soln. by fractional crystn., m. 205° ; $[\alpha]_D^{20}$ (50% soln. by wt. in alc.) 22.4° . Nopinone, obtained from nopinene by 2 successive KMnO_4 oxidations (the 1st giving nopinic acid, which is pptd. as Na salt and oxidized again with KMnO_4 to give nopinone), treated with sodamide and then with C_2H_2 , gives *ethinylnopinol*, $\text{C}_{11}\text{H}_{16}\text{O}$, b_{14} $102\text{--}102.5^\circ$, b_{18} $105\text{--}8^\circ$, n_D^{18} 1.494, d. 0.996, mol. refraction 47.88 (calcd. 48.05), ppts. with Cu_2Cl_2 and with AgNO_3 but not with HgCl_2 .

A. PAPINEAU-COUTURE

Isomerization of an aliphatic tetrahydroterpene. N. D. ZELINSKII AND R. J. LEVINA. *Ber.* 62B, 1861-3(1929).—The shifting of the double bond in an aliphatic compd. from the end C atom has been effected at a relatively low temp. without pressure. 2,6-Dimethyl-7-octene, b_{783} 154° , d_4^{20} 0.7396, n_D^{20} 1.4212, slowly passed (2 drops per min.) in a slow current of CO_2 over Pd asbestos at 200° was completely changed into 2,6-dimethyl-6-octene (dihydrobupleurolene), b_{744} 161° , d_4^{25} 0.7458, d_4^{20} 0.7504, n_D^{20} 1.4259.

C. A. R.

Isomers of 2-pentene. I. 2-Pentene from 3-bromopentane and from 3-pentanol.

MARY L. SHERRILL, BELLE OTTO AND LUCY W. PICKETT. *J. Am. Chem. Soc.* 51, 3023-33(1929).— Et_2CHOH , b. $114.8\text{--}5.2^\circ$, n_D^{20} 1.4078, cooled to -10° , satd. with HBr , heated at 60° and the operation repeated until no more HBr was absorbed, gave 84-5% of Et_2CHBr , b_{760} $118.2\text{--}8.5^\circ$, n_D^{20} 1.4443, d_4^{20} 1.2170. Products obtained by the action of PBr_3 and 48% HBr , which are mixts. of the 2- and 3-Br derivs., are also described. 2-Pentene (I) was prepd. from the s-Br deriv and from Et_2CHOH and purified by fractionation of the const.-b. mixts with MeOH-EtOH . The azeotropic mixt. of I and MeOH b_{760} $31.40 \pm 0.05^\circ$, with EtOH , $34.7 \pm 0.05^\circ$. I b_{760} $36.40 \pm 0.05^\circ$, d_4^{20} 0.6503, n_D^{20} 1.37965. I adds HBr in a non-polar solvent such as CCl_4 to give 98-9% of Et_2CHBr ; in glacial AcOH I adds HBr to give 78% of the 3-Br and 22% of the 2-Br deriv. Addn. of Br to I gives the 2,3-Br₂ deriv. Phys. properties of these derivs. are reported. Sunlight and ultra-violet light transform I into an isomeric form which has slightly different phys. properties. The transformed I adds HBr to form 15% of the 3-Br and 85% of the 2-Br deriv. With Br it forms the 2,3-Br₂ deriv. II. **2-Pentene from 2-bromopentane and from 2-pentanol.** M. L. SHERRILL, CATHERINE BALDWIN AND DOROTHEA HAAS. *Ibid* 3034-41. — PrMeCHBr , b_{760} 117.8° , n_D^{20} 1.4412, results by the action of HBr , PBr_3 or 48% HBr . 2-Pentene (I) was obtained by the action of EtOH-KOH on PrMeCHBr or of 60% H_2SO_4 upon PrMeCHOH and has been obtained practically free from 1-pentene by the fractionation of const.-boiling mixts. with MeOH , the 1-pentene being in the lower-boiling fractions. The phys. properties of the I thus obtained differ slightly from those of the I prepd. from Et_2CHBr , the former having a slightly lower b. p., n and d . This I (without solvent) adds HBr to form 93-5% PrMeCHBr , in a polar solvent, such as glacial AcOH , the I adds HBr to form 85% of PrMeCHBr . It adds Br to form the 2,3-Br₂ deriv. The action of ultra-violet light on the I from Et_2CHBr tends to alter its properties in the direction of those of the isomeric I obtained from PrMeCHBr , while the latter isomer remains practically unchanged by ultra-violet light. The differences in phys. properties between the 2 isomers are such as might be expected in the case of *cis-trans* isomers. The fact, however, that each isomer has been prepd. in a directed manner from a compd. of definite and different polarity and that each adds a polar compd. in a directed manner corresponding to the method of prepn. for each seems to indicate that the 2 isomers are electronic rather than geometrical. Moreover, the fact that the I prepd. from Et_2CHBr is transformed into a more stable form is in accord with this theory. III. **The ultra-violet absorption spectra of the isomeric 2-pentenes.** EMMA P. CARR. *Ibid* 3041-53.—The ultra-violet absorption spectra of the 2-pentene prepd. from Et_2CHBr or Et_2CHOH and of that from PrMeCHBr or PrMeCHOH show marked differences, particularly in the region of the shallow absorption band in the near ultra-violet. The absorption curves of the 2 isomers are so characteristic that they have given an excellent method of identifying these isomers as well as of differentiating them from 1-pentene and the polymeric forms of 2-pentene which may be present as impurities. The effect of a polar solvent, glacial AcOH , as compared with the non-polar solvent, hexane, on the absorption spectra of the 2 isomeric 2-pentenes shows that the AcOH in each case shifts the absorption slightly towards that of the other isomer, while in hexane each curve is almost identical with that for the corresponding pure liquid pentene. These results are in accord with the addn. reactions of the isomeric pentenes in the 2 solvents

and indicate the existence of electronic isomers. In a non-polar solvent each isomer retains its identity; in a polar solvent there is an electronic shift with the consequent formation of some of the other isomer. Absorption spectra measurements of the 2-pentene from Et_2CHBr before and after prolonged exposure to diffused light show a shift in the absorption corresponding to a transformation into the isomeric 2-pentene, together with the formation of some more absorptive polymer. When exposed to ultra-violet light from the Hg arc for 8 to 9 hrs., the absorption spectrum of 2-pentene obtained from Et_2CHBr shows a decided shift of the absorption towards the visible, while the isomeric 2-pentene under identical conditions is quite stable and shows only a very slight shift of absorption in the opposite direction, *i. e.*, toward the absorption curve of the isomeric 2-pentene. The results of the spectrographic exams. of the isomeric 2-pentenenes are in accord with the interpretation of *electronic isomerism* as proposed by Kharasch but are not in agreement with the previously established behavior of geometrical isomers.

C. J. WEST

Induced chlorination of ethylene dichloride. The effect of oxygen upon the reaction between ethylene and chlorine. T. D. STEWART AND DONALD M. SMITH. *J. Am. Chem. Soc.* 51, 3082-95(1929).—Under certain circumstances gaseous C_2H_4 and gaseous Cl react quantitatively to form $\text{C}_2\text{H}_4\text{Cl}_2$; under other circumstances they form only 1,2,2- $\text{C}_2\text{H}_3\text{Cl}_3$ and HCl. The sp. reaction rates for the 2 reactions are the same. The substitution reaction is induced by the addn. reaction, the heat of formation of $\text{C}_2\text{H}_4\text{Cl}_2$ being utilized to promote the formation of $\text{C}_2\text{H}_3\text{Cl}_3$. In the absence of H_2O and light the reactions are autocatalytic. O inhibits the utilization of the reaction energy to promote substitution. N and H_2O have little effect in this respect. O and excess Cl reduce the sp. reaction rate to the same min. value. It is suggested that besides the induced substitution reaction there is also an induced addn. reaction.

C. J. WEST

The catalytic reduction of geraniol and citronellal by means of platinum black. KOJI SUZUKI. *Chem. News* 139, 153(1929).—Reduction of geraniol with Pt black gives the reactions $\text{C}_{10}\text{H}_{18}\text{O} \rightarrow \text{C}_{10}\text{H}_{18}\text{O} \rightarrow \text{C}_{10}\text{H}_{20}\text{O}$, the former reaction being more rapid than the latter. The product has d_4^{18} 0.8555, n_D^{21} 1.45637, $[\alpha]_D = 0^\circ$. A small amt. of FeSO_4 represses the reaction velocity. Citronellal adds 1 mol. H_2 to give dihydrocitronellal, b_r 67°, d_4^{18} 0.8268, n_D^{21} 1.42530, $[\alpha]_D^{21}$ 8.13°. Semicarbazone, m. 78°. Addn. of FeSO_4 hinders reduction of the double bond, yielding citronellol, probably contg. some dihydrocitronellol, b_r 97-97.5°, d_4^{18} 0.8504, n_D^{21} 1.45437, $[\alpha]_D$ 5.40°. A fatigued catalyst is activated by shaking with air.

G. R. YONE

New petroleum by-product: octanesultone. E. L. BALDESCHWIELER AND H. A. CASSAR. *J. Am. Chem. Soc.* 51, 2969-78(1929).—In the manuf. of higher sec. and tert. alcs. the permanent gases from the stills are scrubbed through a strong soln. of H_2SO_4 , the latter is then dild. with H_2O and hydrolyzed, giving a dark liquid which deposits on cooling a black material. The original material as obtained from the refinery contains 62.35% adhering oils, 19.45% octanesultone (I) and 18.20% residue, the latter consisting principally of FeSO_4 . I is isolated by removing the oils with cold gasoline and then extg. the I with boiling 90% C_6H_6 . I has a very faint camphor-like odor, m. 129° and sublimes without decompn. when melted in small quantities; it dists. very readily in steam and seps. in monoclinic needles; the soly. in H_2O at 100° is 1.55 wt. %, at 20° for the following solvents: H_2O 0.025, Et_2O 4.84, 90% C_6H_6 25.88, CHCl_3 55.67, Me_2CO 52.43, MeOH 13.15, abs. EtOH 4.98, 95% EtOH 5.21, iso- PrOH 4.37, normal benzene 0.22; sp. gr. at 20° 1.2973. I (50 g.), refluxed 4 hrs. with 30 g. Ba(OH)_2 in 500 cc. H_2O , gives the Ba salt Type "A," needles, which may be recrystd. from abs. EtOH and Et_2O ; from H_2O the salt decomp. partially on drying; Ag salt, by double decompn. with Ag_2SO_4 ; K salt, from I and KOH. The Ba salt and H_2SO_4 regenerate I. I (25 g.), refluxed with 200 cc. of 15% KOH for 20 hrs. and the cooled soln. treated with excess Br, gives 34 g. of bromooctanesultone Type "A," m. 112°; Cl deriv., prep'd. similarly, m. 122.5°; the reaction is $\text{C}_{10}\text{H}_{18}\text{S}_2\text{O}_7\text{Ba} + 2\text{Br} \cdot 2\text{C}_6\text{H}_5\text{Br} \cdot \text{BaSO}_4 + \text{BaBr}_2 + \text{H}_2\text{O}$. Hydrolysis with Ba(OH)_2 or KOH gives the corresponding salts. Removal of the Ba from the Type A salt with a slight excess of H_2SO_4 gives the octanehydroxysulfonic acid, m. 90°. Refluxing 25 g. I 12-16 hrs. with 14 g. BaCO_3 and 50 cc. H_2O gives the Ba salt Type "B," which did not cryst.; with Br it gives brom. octanesultone Type "B," m. 139°; Cl deriv., m. 118.5°. Hydrolysis of the Cl deriv. gives the Ba salt of octanesultone, the latter m. 92.5° and yielding a Br deriv., m. 117°. I (25 g.) and 9 g. CaCO_3 in 400 cc. H_2O , refluxed overnight, give about 26 g. Ca salt Type "C," (the Ba salt is made in the same manner with a large excess BaCO_3), which in alk. soln. gives with Br a mixt. of octyl bromides. When H_2SO_4 is added to the Ca

salt and the mixt. distd. with steam, there results an octene, b. $113-5^{\circ}$, which does not yield a solid nitroschloride. The difference in the chem. properties of the various types of salts is explained by a shifting of the double bond generated from the HO group. The aliphatic sulfones, being volatile with steam, may be partly responsible for the S content of refined gasolines. C. J. WEST

Constitution and the dissociation of the Grignard reagent. HENRY GILMAN AND ROBERT E. FOTHERGILL. *J. Am. Chem. Soc.* **51**, 3149-57(1929).—From the results of a study of 14 expts in which various RMgX reacted with Ph_2CO , evidence is presented for the equil. $2\text{RMgX} \rightleftharpoons \text{R}_2\text{Mg} + \text{MgX}_2$ and for the dissocn. $\text{RMgX} \rightarrow \text{R}- + -\text{MgX}$, of Grignard reagents C. J. WEST

Reactions relating to carbohydrates and polysaccharides. XXIII. Synthesis and properties of hydroxyalkylideneglycols and glycerols. HAROLD HIBBERT AND MYRON S. WHELEN. *J. Am. Chem. Soc.* **51**, 3115-23(1929); cf. *C. A.* **23**, 1402-3.—Condensation of 80 g. CH_2CHCHO and 120 g. $(\text{CH}_2\text{OH})_2$ with 40 cc. HCl at $0-4^{\circ}$ gives 70 g. β -chloropropylideneglycol (2-[β -chloroethyl]-1,3-dioxolane), b_p $70-2^{\circ}$, which gradually turns dark brown in color, warming with dil. aq. acid gives a very obnoxious odor, probably $\text{ClCH}_2\text{CH}_2\text{CHO}$, dry KOH in a Cu vessel gives about 50% of acrylideneglycol (2-allyl-1,3-dioxolane), b. $115-6^{\circ}$, with a strong, sweetish, slightly unpleasant odor; hydrolysis with dil. acids gives CH_2CHCHO . Oxidation with nearly satd. KMnO_4 soln. at 5° gives 41% of 1,2-dihydroxypropylideneglycol (2-dihydroxyethyl-1,3-dioxolane), b_p $136-8^{\circ}$, n_D^{17} 1.4695. Condensation of 112 g. CH_2CHCHO and 184 g. $\text{C}_6\text{H}_5(\text{OH})_3$ by heating several weeks at $50-60^{\circ}$ gives 10-5% of 1,2-acrylideneglycerol (2-allyl-1,3-dioxolane-4-carbinol) (I), b_p $98-105^{\circ}$, b $204-15^{\circ}$, n_D^{17} 1.4638, no indication was observed of the presence of the corresponding 6-membered acetal. I, MeI and Ag_2O give the α -Me ether, b_p 70° , b_{760} $174-8^{\circ}$, n_D^{17} 1.4408, which polymerizes after standing several months. Hydrolysis gives glyceryl α -Me ether, while oxidation gives 1,2-dihydroxypropylideneglycerol 1'-Me ether, b_{1-2} 146° , n_D^{17} 1.4680, which has no tendency to polymerize. Oxidation of I gives an oil, b_2 51° , which was not identified and a smaller amt. of 1,2-dihydroxypropylidene-1,2-glycerol (1,2-dihydroxyethyl-1,3-dioxolane-4-carbinol), b_3 $200-1^{\circ}$, n_D^{17} 1.4888, which has no tendency to polymerize. C. J. W.

Photochemical decomposition of lactic acid. G. RICHARD BURNS. *J. Am. Chem. Soc.* **51**, 3165-71(1929).—Lactic acid in H_2O is decomposed by radiations of wave lengths shorter than 2500 \AA . The chief products of decompn. by radiations from a quartz Hg arc are EtOH and CO_2 . CO , satd. and unsatd. hydrocarbons form about 9% of the gaseous products. Aldehyde, if produced, is present in quantities less than 1% of the total decompn. products. The ratio between the energy absorbed and the CO_2 produced corresponds to a quantum yield of approx. 0.65. More EtOH is produced than is required by the assumption that lactic acid decomps. into equal amts. of EtOH and CO_2 . The higher % of short wave length from the Hg arc produces a different type of decompn. from that produced by the Hg arc. The mixt. of gases produced changes in compn. with increasing age of the Hg arc. C. J. WEST

Preparation of *d*-glucuronic acid from gum arabic. FRITZ WEINMANN. *Ber.* **62B**, 1637-9(1929).—By short hydrolysis of *l*-rotatory gum arabic (Khordofan gum) with 0.5 *N* HCl there is obtained 40% of a gum acid with $[\alpha]_D^{23} -8.3^{\circ}$ (H_2O), contg. galactose bound to *d*-glucuronic acid (I). This on energetic hydrolysis (best with boiling *N* H_2SO_4) gives through the Ba salt almost pure I in 30% yield (based on the amt. present in the gum acid as detd. by the Tollens-Lefèvre method), or about 50 g. from 1 kg. of the gum. One crystn. from 90% alc. gives a pure product, m. 156° , $[\alpha]_D^{23}$ in H_2O (*c* 2.148) 13.5° (initial), 35.2° (after 2 hrs.). C. A. R.

Some observations on the acetoacetic ester condensation. S. M. McELVAIN. *J. Am. Chem. Soc.* **51**, 3124-30(1929).—Various theories of the $\text{AcCH}_2\text{CO}_2\text{Et}$ reaction are discussed. A study has been made of the action of EtONa on 4 simple esters, the reversal of the condensation was overcome by the removal of the EtOH by distn. as it was formed in the reaction. In this way the following yields of β -keto ester and EtOH were obtained: AcOEt , 68, 83, EtCO_2Et , 81, 97; PrCO_2Et , 76, 103; $\text{iso-PrCO}_2\text{Et}$, 0, 6%. The fact that the yield of the 2 products is not the same is due to difficulties of isolation and detn. On the basis of these results it seems that the original mechanism of the condensation proposed by Claisen, supplemented by the reversible feature, is the most acceptable of those that have been considered. C. J. WEST

New derivatives of creatinine and diketopiperazine. I. H. RICHARDSON AND CLAUDE E. WELCH WITH S. CALVERT. *J. Am. Chem. Soc.* **51**, 3074-9(1929).—Heating 5 g. creatinine and excess BzH or an equiv. amt. of PhN:CHPh gives 5-benzalcreatinine,

golden yellow, m. 244°; 5-m-nitrobenzal deriv., yellow, decomps. 288° (70% yield); 5-m-methoxy-p-hydroxybenzal deriv., decomps. 267° (75% yield). Heating 1.4 g. glycine anhydride, 4.5 g. vanillin, 4 g. AcONa and 8 g. Ac₂O at 120–30° for 8 hrs. gives 3,6-bis-[m-methoxy-p-acetoxybenzal]-2,5-diketopiperazine, bright yellow; in a similar manner were prepd. the following derivs.: cinnamal, piperonylidene, m-acetoxybenzal, methylbenzal (I) and o-chlorobenzal. The presence of HO groups in the enol form of diketopiperazine has been confirmed by the formation of the α -naphthyl isocyanate deriv., C₂₆H₂₀N₄O₄, m. 232° (decompn.); this condenses with aldehydes only after hydrolysis, the same product (I) being obtained with m-MeC₆H₄CHO as is obtained above. The m-nitrobenzal deriv. was obtained from this deriv. It therefore appears that the ordinary enol form of diketopiperazine has double bonds between C atoms. C. J. WEST

Reactivity of glucose in the presence of hydrochloric acid. II. EMYR ALUN MOELWYN-HUGHES *Trans. Faraday Soc.* **25**, 435–42 (1929); cf. C. A. **22**, 1888.—Evidence is adduced to show that condensation of glucose to diglucose is not due to a structurally active γ -glucose, but to a thermally stimulated glucopyranose mol., resembling normal glucose in structure but differing from it in being temporarily physically activated. LOUIS WALDBAUER

New conditions for the formation of glucosazone. C. L. BUTLER AND LEONARD H. CRETCHER *J. Am. Chem. Soc.* **51**, 3161–5 (1929).—The reaction of glucose or fructose with an equimol. amt. of PhNHNH₂ in cold dil. AcOH gives a high yield of glucosazone, instead of glucose phenylhydrazone as might be expected. Mannose, on the other hand, yields only the hydrazone under these conditions. Glucose and fructose phenylhydrazones are converted practically quant. to glucosazone on standing in dil. AcOH. Mannose phenylhydrazone is unchanged by this treatment. C. J. WEST

From formol to hexobioses. E. CATTELAÏN *J. pharm. chim.* [8], **9**, 70–7, 113–22, 153–63 (1929).—Historical review of the synthesis of the sugars, culminating in the recent syntheses of lactose, (C. A. **21**, 3602), maltose (C. A. **21**, 3046), sucrose (C. A. **22**, 2743), etc. Structural formulas and a list of 30 references are given. S. W.

Sequoiyte (sequoyitol) a cyclose from redwood (Sequoia sempervirens). E. C. SHEPARD AND E. F. KURTH. *J. Am. Chem. Soc.* **51**, 3139–41 (1929); cf. C. A. **22**, 2739.—The aq. ext. of redwood contains a mixt. of pinitol and sequoyitol (I), sepd. by fractional crystn. I crystallizes readily from a 50% EtOH, while pinitol crystallizes from a 70% soln. The yield on the basis of the wt. of the oven-dried heartwood varies from traces to 0.06%. I m. 234–5° and sublimes at temps. above this; it is optically inactive, does not reduce Fehling soln., gives no ppt. with PhNHNH₂ and is not affected by dil. acids or alkalis; with HNO₃ it is oxidized to (C₆H₅)₂. With Ac₂O and AcONa I gives a *pentacetate*, m. 198°. With HI I gives MeI and *dl*-inositol. I is therefore the monomer ether of *dl*-inositol. C. J. WEST

Polymethylbenzenes. I. Study of the Jacobsen reaction with pentamethylbenzene and the preparation of prehnitene. LEE I. SMITH AND ALBERT R. LUX. *J. Am. Chem. Soc.* **51**, 3004–3000 (1929).—The rearrangement known as the Jacobsen reaction (*Ber.* **20**, 896 (1887)) takes place essentially in the manner reported by J., although there are considerable amts. of tarry by products and J.'s equation does not represent all that happens. A typical reaction, of which 12 are reported, consisted in heating 74 g. C₆HMe₅ at 65° and adding the resulting oil, with vigorous stirring, to 200 cc. concd. H₂SO₄ at room temp. The mixt. is then cooled to room temp. and allowed to stand 24 hrs., after which it is cooled to 0°, 165–200 g. ice added in 3 portions and the product filtered. The filter cake is leached with about 700 cc. cold H₂O; the residue contains crude C₆Me₆ while the filtrate contains C₆HMe₅SO₃H. The C₆Me₆ is purified by distn. *in vacuo* and is obtained in over 70% yields. The C₆HMe₅SO₃H is best obtained by dropping the C₆HMe₅SO₃H in H₂O or as a thin paste in H₂O into dil. H₂SO₄ at 140–50° and distg. the C₆HMe₅SO₃H with steam as rapidly as it is formed by hydrolysis; the yield is 88% of the Na salt or about 65% based on the C₆HMe₅ used. In a run with 1000 g. C₆HMe₅ there were obtained 264 g. crude C₆HMe₅SO₃H and 610 g. crude C₆Me₆. The last step in the reaction is a sulfonation of the C₆HMe₅; it is the SO₃H acid, not the hydrocarbon, which rearranges. II. The melting points of the tetramethylbenzenes and of penta- and hexamethylbenzene and the freezing-point diagram of durenene and isodurenene. LEE IRVIN SMITH AND F. H. MACDOUGALL. *Ibid.* 3001–8.—Durenene (1,2,3,4-C₆H₄Me₄), recrystd. 4 times from 95% EtOH and then from C₆H₆, m. 79.28 ± 0.05°. C₆HMe₅, purified similarly, m. 54.0 ± 0.1°. C₆Me₆, recrystd. 4 times from CHCl₃ and then from C₆H₆, m. 164.8 ± 0.1°. Isodurenene (1,2,3,5-C₆H₄Me₄) was prepd. as follows: 1,3,5-C₆H₃Me₃ was brominated (the Br deriv. b_m, 105–7°, b₁₁, 102.5–3.5, m. 1° to +1°, yield 76–85%); the Grignard reagent from this and Me₃SO₄ give

1,2,3,5- $C_6H_3Me_4$, b_{17} 84.6-4.7°, m. -24.0 \pm 0.1° (60% yield). Prehnitene (1,2,3,4- $C_6H_3Me_4$) was prepd. according to the preceding paper; it was purified by converting it into the Br deriv., b_{50} 166-7°, m. 24°, and regenerating the hydrocarbon by the Grignard reagent and also through the picrate, m. 89.5-90.5°; the final product $b_{6.3}$ 75.0-5.5° (cor.) and m. -6.40 \pm 0.05°. The f.-p. curve for the system durenene-isodurene is given; from these data the mol. latent heat of fusion of isodurene is calcd. to be about 2550 cal. and of durenene to be 5022 cal.

C. J. WEST

***p*-Cymene studies. XII. 2-*p*-Cymyl-4-semicarbazide and certain derivatives.** ALVIN S. WHEELER AND J. G. PARKS. *J. Am. Chem. Soc.* **51**, 3079-82(1929); cf. *C. A.* **23**, 115.—Aminocymene and $CO(NH_2)_2$ give *di-p*-cymylurea, m. 240°; with $KCNO$ it gives *p*-cymylurea, which with $PhNHNH_2$ yields 2-*p*-cymyl-4-semicarbazide, m. 112°; *HCl* salt, m. 166-8° (decompn.). The following semicarbazones were prepd. from this reagent: acetone, m. 182° (all m. p. cor.); methyl ethyl ketone, m. 182-3°; α,γ -dichloroacetone, m. 173°; mesityl oxide, m. 163°; *Et* acetoacetate, m. 133.5°; cyclohexanone, yellow, m. 192.5°; camphor, yellow, m. 217°; curvone, yellow, m. 97°; benzophenone, m. 150°; acetophenone, m. 212°; benzoin, yellow, m. 172°. **XIII. *p*-Cymylhydrazine-2 and derivatives.** ALVIN S. WHEELER AND CHARLES L. THOMAS. *Ibid* 3135-9.—Reduction of the diazo compd. from 2-aminocymene (prepd. with $NaNO_2$) with Na_2SO_3 gives 72.5% of *p*-cymyl-2-hydrazine (I), m. 26.5°, b_5 129 32°, d_{28}^{20} 0.98623, n_D^{25} 1.5551; *HCl* salt, m. 198°; *II* Br salt, m. 174°; sulfate, m. 130°; picrate, yellow, decomp. 124°. The following hydrazones were prepd. from I: cinnamaldehyde, picric yellow, m. 90°; salicylaldehyde, yellow, m. 87°; benzophenone, slightly brown, m. 88°; *Me Et* ketone, unstable, m. 57°. With $CO(NH_2)_2$ I gives 1-*p*-cymyl-2-semicarbazide, m. 171°; the *thio* deriv., m. 184°. I and $p-O_2NC_6H_4COCl$ give the *p*-nitrobenzoyl deriv., yellow, m. 177°. CS_2 gives a compd. contg. 18.75% N and 21.25% S, m. 177°. C. J. W.

Cleavage of azo dyes by means of sulfites. KARL H. ENGEL. *J. Am. Chem. Soc.* **51**, 2986-94(1929).—Monoazo dyes combine with 2 mols. of a neutral sulfite, in soln., suffering cleavage into a primary amine and the salts of *N*- SO_3H and *N*-di- SO_3H acids. 4- $HOC_6H_4N_2Ph$ yields approx. 0.78 mol. $PhNH_2$, 0.22 mol. of an *N*- SO_3H deriv. of $PhNH_2$, 0.78 mol. of an *N*-di- SO_3H and 0.22 mol. of an *N*- SO_3H deriv. of 4- $HOC_6H_4NH_2$ but no traces of unsulfonated $HOC_6H_4NH_2$. 4,4'- $HOC_6H_4N_2C_6H_4SO_3H$ reacted similarly, sulfanilate being formed as a result of cleavage. Hydrolysis and rearrangement of free *N*- SO_3H derivs. resulted in complete recovery of the primary dye component in its original form; the sec. component yielded 4,5- $HO(SO_3H)_2C_6H_3NH_2$ and an extremely sol. stable 1-amino-4-phenolsulfonic acid. An explanation of the cleavage reaction has been suggested, founded on an assumption of functional differences between the 2 N atoms of the azo group. The original should be consulted for the exptl. details of the sepn. of the cleavage products.

C. J. WEST

Constitution of triphenylsilicane and its reaction with sodium in liquid ammonia. HARRY H. REYNOLDS, LUCIUS A. BIGELOW AND CHARLES A. KRAUS. *J. Am. Chem. Soc.* **51**, 3067-72(1929).— $PhMgBr$ and $SiHCl_3$ give 73% of triphenylsilicane, b_2 152-67°, m. 36-7°; this is quantitatively brominated, giving Ph_3SiBr and HBr , which was hydrolyzed to Ph_3SiOH . In liquid NH_3 , Ph_3SiH and Na give *di*[triphenylsilicon]imine (I), m. 175°; its constitution was established by hydrolysis with HCl , giving NH_4Cl and Ph_3SiOH . Upon bromination I gives Ph_3SiBr , $PhBr$, a little $(Ph_3Si)_2O$ and pasty by-products. I is quantitatively stable to boiling alkali.

C. J. WEST

Series arrangement of organic groups. I. As determined by the halogenation of mixed stannanes. RALPH H. BULLARD. *J. Am. Chem. Soc.* **51**, 3065-7(1929).— Ph_3SnNa and $PhCH_2Cl$ in liquid NH_3 give triphenylbenzylstannane, m. 90-1°, bromination in $C_6H_6-CCl_4$ gives $PhBr$ and phenylbenzylstannyl dibromide, m. 74-5°. From this result and other data from the literature the series arrangement of some org. groups based on the relative ease of removal from Sn by halogen is: Ph , $PhCH_2$, Me , Et , Pr .

C. J. WEST

Triphenyllead chloride and diphenyllead dichloride. HENRY GILMAN AND JACK D. ROBINSON. *J. Am. Chem. Soc.* **51**, 3112-4(1929).— Ph_3PbCl is obtained in about 75% yield by passing HCl into Ph_4Pb in $CHCl_3$ near its b. p. for about 15 min. or until crystals of Ph_2PbCl_2 begin to sep.; after boiling the soln. until all the HCl has reacted and evapg. the $CHCl_3$, boiling $EtOH$ exts. the Ph_3PbCl . Excess HCl and Ph_4Pb in C_6H_6 at 50° give 98.5% of Ph_2PbCl_2 .

C. J. WEST

***N*-Phenyl- β -aminopropionamide-4-arsonic acid and related compounds.** CLIFF S. HAMILTON AND CARTER L. SIMPSON. *J. Am. Chem. Soc.* **51**, 3158-61(1929).— β -Bromopropionyl chloride, from the acid and PCl_5 , b_{21-20} 65-70°; concd. NH_4OH gives β -bromopropionamide, m. 110-1°. One mol. equiv. of the aminoarylarsonic acid in the

calcd. amt. of *N* NaOH to form the Na salt is treated with 1.5 mol. equivs. of the amide and boiled for 5 hrs.; sufficient concd. HCl is added to the hot soln. to hold any unchanged As acid in soln. There were thus prepd. *N*-phenyl- β -aminopropionamide-4-arsonic acid (I), 35–40% yield (Na salt, needles); the 2-methyl-4-deriv., 25–30% and the 2-methyl-5-deriv., 15–20%. Hydrolysis of I by boiling with 2 *N* NaOH for 3 hrs. gives *N*-phenyl- β -aminopropionic acid-4-arsonic acid, does not m. at 250°. *N*-4-Methylcarbamidophenylarsonic acid results in 25% yield from MeNHCOCl and *p*-H₂NC₆H₄AsO₃H₂. I (5.8 g.) and 4.7 g. 3,4-H₂N(HO)C₆H₃AsO₃H₂ in 50 cc. concd. HCl and 30 cc. H₂O, treated with 50 cc. 50% H₂P₂O₆, give 4.2 g. of 3-amino-4-hydroxy-4'-propionamidaminoarsenobenzene-di-HCl, yellow; the free base, yellow, decomps. 120–5°. Preliminary pharmacol. tests indicate that I may be useful in treatment of trypanosomal infections.

C. J. WEST

Monobromoguaiacol carbonate. Estimation of guaiacol carbonate. LEWIS H. CHERNOFF. *J. Am. Chem. Soc.* **51**, 3072–4 (1929).—Guaiacol carbonate (I) and Br in MeOH give the *Br* deriv., m. 178°. I may be detd. by heating 0.1–0.5 g. in 10–20 cc. MeOH until soln. results, adding 1 cc. Br, allowing the mixt. to stand 10 min., then adding an equal vol. H₂O and again allowing to stand 10 min. The ppt. is washed with 50% MeOH. The error is from 1.2% with 0.5 g. to 0% with 0.01 g. I. The error is larger if only 0.25 vol. of H₂O is added. In mixts. with the usual excipients a preliminary sepn. by the use of proper solvents may be made.

C. J. WEST

Preparation of quinhydrone. P. MÜLLER. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 170 (1929).—Quinhydrone may be prepd. in the lab. from NH₄Fe(SO₄)₂ and hydroquinone at a small fraction of the cost of the com. product.

R. M. B.

Beckmann rearrangement in the presence of free radicals. EVERETT S. WALLIS. *J. Am. Chem. Soc.* **51**, 2982–6 (1929).—PhCH₂CHMeCON₃, allowed to rearrange in the absence of air in a C₆H₆ soln. of Ph₃C, gives only PhCH₂CHMeNCO. A discussion of this fact with reference to certain theories on the Beckmann rearrangement is given.

C. J. WEST

1,6-Addition of hydrogen to unsaturated 1,4-diketones. ROBERT E. LUTZ. *J. Am. Chem. Soc.* **51**, 3008–23 (1929).—(*p*-ClC₆H₄COCH)₂ (70 g.) and Br in CHCl₃ give 49 g. of the *meso*-di-*Br* deriv. and 49.5 g. of *dl*-1,2-di[4-chlorobenzoyl]-1,2-dibromoethane, m. 124.5°; in AcOH 50 g. of the ethylene gives 55 g. of the *meso*- and 18 g. of the *dl*-di-*Br* derivs. With 2 equivs. of MeONa there results 1,2-di[4-chlorobenzoyl]methoxyethane, m. 130°. 1,2-Dibenzoyl-3-methoxyphenoxyethylene, m. 110°, in 10% yield from *m*-MeOC₆H₄OH, (BzCHBr)₂ and EtONa. *m*-MeC₆H₄OH gives 2 forms of 1,2-dibenzoyl-3-methylphenoxyethylene, m. 95° and 103°. Reduction of BzCH₂C(OMe)Bz with Na₂S₂O₄ in EtOH and H₂O gives diphenylmethoxyfuran, m. 48.5–9°; long heating does not appreciably affect the yield of the furan, so that the BzCH₂CH(OMe)Bz, once formed, is stable and not appreciably dehydrated to the furan under these conditions. Ac₂O and concd. H₂SO₄ do not dehydrate the ethane to the furan but give oils and a colorless solid to be investigated later. Decompn. of BzCH₂CH(OMe)Bz by heating at 210–5° for 20 min. gives MeOH and (ClC₆H₄COCH)₂. ClC₆H₄COCH·C(OMe)COC₆H₄Cl, Ac₂O, AcOH and Zn, on boiling, give 2,5-di[4-chlorophenyl]methoxyfuran, m. 114°; reduction with Na₂S₂O₄, EtOH and H₂O gives 1,2-di[4-chlorobenzoyl]methoxyethane, m. 61.5°, which is converted into the furan by Ac₂O and a trace of H₂SO₄. Heating the ethane at 200° for 10 min. gives MeOH and (ClC₆H₄COCH)₂. Reduction of BrC₆H₄COCH·C(OMe)COC₆H₄Br with Zn and AcOH gives 2,5-di[4-bromophenyl]methoxyfuran, m. 113°; reduction with Na₂S₂O₄ gives 1,2-di[4-bromobenzoyl]methoxyethane, m. 72°, which decomps. at 210–20° as the Cl deriv. Reduction of BzCH₂C·(O⁺Ph)Bz by Zn and AcOH, CrCl₃ or Na₂S₂O₄ gives 1,2-dibenzoylphenoxyethane, m. 120°. Ac₂O and H₂SO₄ give 2,5-diphenyl-3-phenoxyfuran, m. 91°. 1,2-Dibenzoyl[4-methylphenoxy]ethane, m. 108.5°; 2,5-diphenyl-3-[4-methylphenoxy]furan, m. 113°. The action of reducing agents on unsatd. 1,4-diketones is given as a table, the % yields of the ethane and furan being given. In some cases the MeO or aroxyl group is removed by the action of the reducing agent. The bearing of these facts on the theory of 1,6-addn. of H to unsatd. 1,4-di-C:O compds. is discussed and the conclusion is drawn that the dienol postulated by the theory is actually formed as the primary intermediate in reduction and accounts for the formation of the furans.

C. J. WEST

Reactions of vinyl chloride and benzene in the presence of aluminium chloride. JAMES M. DAVIDSON and ALEXANDER LOWY. *J. Am. Chem. Soc.* **51**, 2978–82 (1929).—CH₂.CHCl, C₆H₆ and AlCl₃ give Ph₂CHMe (I), 9,10-dimethyldihydroanthracene (II) and an anthracene-type resin. No styrene or metastyrene was formed. PhCHClMe is considered as the most probable intermediate. Increased amts. of AlCl₃ at low temps. decreased the amts. of I. The amts. of II were increased by using a higher temp.

or by the presence of I. Hg caused the formation of PhEt and considerably decreased the amt. of resin formed. Certain phys. and chem. properties of the resin have been studied.

C. J. WEST

1,2-Benz-3,4-anthraquinone. LOUIS F. FIESER AND EMMA M. DIETZ. *J. Am. Chem. Soc.* **51**, 3141-8(1929).—(4-Methoxynaphthyl-1)-phenylmethane-2'-carboxylic acid, m. 221-3° (cor.), results in 91% yield by reduction of the corresponding naphthoyl deriv. with Zn and NaOH; ring closure takes place with concd. H₂SO₄ at 20°, giving 3-methoxy-1,2-benz-10-anthrone, pale yellow, very sensitive to heat and to O, particularly in soln., and was not purified (*Ac deriv.*, m. 197° (cor.)). Reduction with Al-Hg and NH₄OH under very carefully controlled conditions gives 45-55% of 3-methoxy-1,2-benzanthracene (I), straw-colored, m. 167-8°, oxidized in AcOH with Cr₂O₃ to 3-methoxy-1,2-benz-9,10-anthraquinone, brown-red, m. 188.5°, which forms a red vat with alk. Na₂S₂O₄; the concd. H₂SO₄ soln. is deep blue-green. Hydrolysis of I with 40% HBr gives 3-hydroxy-1,2-benzanthracene (II), orange-yellow, m. 196-205° (*Ac deriv.*, m. 129°). Oxidation of the *Ac deriv.* gives nearly quant. 3-acetoxy-1,2-benz-9,10-anthraquinone, yellow, m. 232°. Sapon. gives the 3-HO deriv., which was not purified. II yields a 4-[*p*-nitrobenzeneazo] deriv., dark red, which is reduced in the moist state in BuOH with SnCl₂ and concd. HCl, giving 4-amino-3-hydroxy 1,2-benzanthracene, decomps. easily in soln. in the absence of a reducing agent but analyzed as the triacetate, m. 203-5° (cor.) and as the oxazole deriv., C₂₀H₁₁ON, light yellow, m. 175.5°; oxidation with Cr₂O₃ in AcOH gives 57% of 1,2-benz-3,4-anthraquinone (III), red, m. 262-3° (cor., some decompn.). Reduction and acetylation gives 3,4-diacetoxy-1,2-benzanthracene, m. 201° (cor.), oxidized to 3,4-diacetoxy-1,2-benz-9,10-anthraquinone, yellow, m. 198.9°, which in turn is hydrolyzed to the 3,4-di-HO deriv., purplish black powder. Oxidation of III with H₂O₂ in AcOH gives 4,5-benzodiphenyl 2,2' dicarboxylic acid, pale tan, m. 252° (cor.), and giving with concd. H₂SO₄ 1,2(or 2,3)-benzo[*a*]norenone-4(or 5)-carboxylic acid, yellow, m. 268° (cor.).

C. J. WEST

Reduction potentials of various phenanthrenequinones. LOUIS F. FIESER. *J. Am. Chem. Soc.* **51**, 3101-11(1929).—The normal reduction potentials at 25° of 43 phenanthrenequinones have been detd. and an analysis of the data indicates that an isophenanthrenequinone, such as 1,4-phenanthrenequinone, has a somewhat higher potential than the corresponding naphthoquinone; the difference results from the substituting of a C₁₀H₈ group for the less reactive C₆H₄ group. The abnormally high potential of the 9,10-deriv. is due to a strain resulting from some peculiar spatial arrangement of the mol. Among the substituted 9,10-phenanthrenequinones, a group has the same effect on the potential when it is *o*- or *p*- to a quinonoid CO group and the effect is much greater than when the substituent occupies either of the *m*-positions. A 2nd substituent has a somewhat greater influence than the 1st. The potential is increased by the substitution of NO₂, CN, CO, CO₂H, Br and SO₂H groups; it is decreased by NH₂, alkyl, HO and MeOH groups. *Ac phenanthrene-3-carboxylate*, m. 97°; oxidation gives the *quinone*, orange-yellow, m. 212°. 3-Benzoylphenanthrenequinone, golden yellow, m. 205-6°.

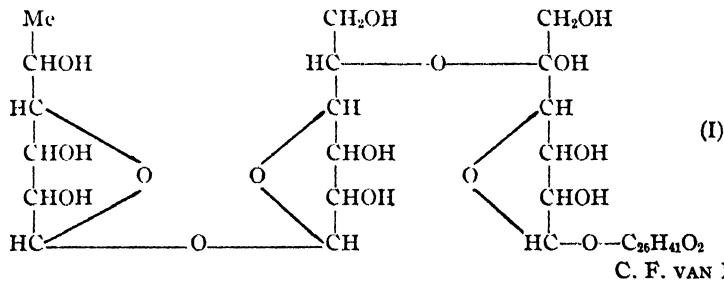
C. J. WEST

α -Furfuryl chloride and its derivatives. II. W. R. KIRNER AND G. HOLMES RICHTER. *J. Am. Chem. Soc.* **51**, 3131-5(1929); cf. K., *C. A.*, **22**, 3162.—Furfuryl chloride (I) and CH₂(CO₂Et)₂ give 76% of the *Et ester* (II), b₄ 125.5-7°, d₂₀²⁰ 1.11196, d₄²⁰ 1.10999, n_D²⁰ 1.4591, of α -furfurylmaleonic acid. II and EtI give the *Et deriv.*, b₅ 135.5-6.5° (67% yield); with CO(NH₂)₂ and EtONa this gives α -furfurylbarbituric acid, m. 186-7.5° (37% yield); *Et deriv.*, m. 144.5-5° (51% yield). *Et* α -furfurylacetate, b₄ 110-1.5°, d₂₀²⁰ 1.10562, d₄²⁰ 1.10366, n_D²⁰ 1.4718 (61% yield); acid decompn. gives 75% of 2- α -furfurylacetic acid, m. 56.5-8°, and 12% of α -furfurylacetone, whose semicarbazone m. 140-1°. I and NaCN in H₂O at 70° give 90% of α -furfuryl nitrile, b₂₇ 74-5°, d₂₀²⁰ 1.04813, d₄²⁰ 1.04627, n_D²⁰ 1.4833, hydrolyzed to α -furylacetic acid, m. 108.5-9.5° (43% yield). α -Furfuryl thiocyanate, b₂₇ 111.5-2.5°, b₂ 66-7°, d₂₀²⁰ 1.18919, d₄²⁰ 1.18709, n_D²⁰ 1.5614. I, condensed with CS(NH₂)₂ and then hydrolyzed, gives α -furfuryl mercaptan, b₆₅ 84°, d₂₀²⁰ 1.13386, d₄²⁰ 1.13186, n_D²⁰ 1.5329; the Na deriv. and EtBr give α -furfuryl *Et sulfide*, b₂₈ 90.5-1°, d₂₀²⁰ 1.05144, d₄²⁰ 1.04958, n_D²⁰ 1.5140.

C. J. WEST

Saponins and allied compounds. XXI. The sarsaparilla saponins and their hydrolysis products. The synthesis of a saponin from parigenin and β -glucose. A. W. VAN DER HAAR. *Rec. trav. chim.* **48**, 726-42(1929); cf. *C. A.* **22**, 1979.—The pulverized Honduras root gave on extrn. with petroleum ether a substance which on hydrolysis yields sitosterol (Lieberman test for cholesterol). Then the root was extrd.

with ether, giving a residue which, on crystn. from EtOH-AmOAc, gave *sitosterol glucoside*, m. 290–95° (cf. P. and S., *l. c.*). On hydrolysis this glucoside gave *sitosterol*, m. 130°. After the extrn. with petroleum ether and ether the root was extd. with 99% MeOH; from the MeOH soln. the saponins were pptd. by means of ether and then purified by dialysis. Recrystn. from 30% EtOH gave a small amt. of the saponin *parillin*, far the greater part being kept in soln. by the sarsasaponin. After several crystns. from 30% EtOH the *parillin*, $C_{44}H_{72}O_{17} \cdot 6H_2O$, m. 238–40°; $[\alpha]_D -63.7^\circ$, mol. wt. (Rast) 842 for the anhyd. substance (calcd. 872); by means of the Zerevitinov method the presence of 10 OH groups was demonstrated. On hydrolysis with 5% H_2SO_4 in 30% EtOH *parillin* yields the sapogenin *parigenin*, $C_{26}H_{42}O_4$ with 1–1.5 H_2O , m. 200° when prepd. from Honduras root and 203° when obtained from Vera Cruz root, contains 1 OH group according to the method of Zerevitinov, $[\alpha]_D -69.6^\circ$, mol. wt. 337 in phenol, 1119 in benzene (b.-p. method) and 3441 in benzene (f.-p. method); (calcd. 402); *acetylparigenin*, m. 130°. On distn. over Zn powder in a H atm., *parigenin* yields a hydrocarbon with a mol. weight of 190°, probably a sesquiterpene. The hydrolysis of *parillin* only gives *rhamnose* and *glucose* and the quant. detn. showed that 1 mol. of the saponin yields 1 mol. of *rhamnose* and 2 mols. of *glucose* (cf. van der Haar, *Anleitung zum Nachweis usw. der Monosaccharide und Aldehydsäuren*, Bornträger, Berlin, 1920). As *parigenin* only contains 1 OH group while *parillin* has no reducing properties, it follows that *parigenin* is bound to a trisaccharide by means of this OH group. Partial hydrolysis of *parillin* yields *rhamnose* and a prosapogenin which only contains *glucose* and therefore the configuration I is ascribed to *parillin*, which contains 10 OH groups, as was shown experimentally. The soln. of sarsasaponin and *parillin*, which was obtained after part of the latter had crystd. (see above), was hydrolyzed with 5% H_2SO_4 and investigated according to v. d. H.; pentoses, *d*-galactose *d*-mannose, *d*-fructose and aldehydic acids were shown to be absent, while the presence of *rhamnose* (m. 92°; *p*-tolylhydrazone, m. 166°) and *glucose*, m. 148°, $[\alpha]_D 52^\circ$ (phenyllosazone, m. 208°), was demonstrated. From the root already extd. with petroleum ether, ether and 99% MeOH, the Ca-Mg compd. of a polysaccharide was obtained by extrn. with boiling 45% EtOH the so-called polysaccharide was shown to consist of 8.2% water, 1% ash, 5.1% pentoses, 2.95% methylpentoses, 3% aldehydic acids, 42.5% hexoses and 7.4% insol. matter, total 70.15%, the rest is to be regarded as impurities. On 5 g. *parigenin* in 40 cc. dry toluene and 4 cc. dry quinoline with 5.1 g. acetobromoglucose during a few min. and sapon. the Ac groups, *parigenin glucoside*, m. 225–30°, was obtained in 2% yield; this, on hydrolysis with 4% H_2SO_4 , gave *parigenin*, m. 206°.



Parachor and chemical constitution (SUGDEN, *et al.*) 2. Organic dipole molecules with singly and doubly bound O (WOLF) 2. Volume of metal alkyls (HERZ) 2. Reactions of C_2H_4 , H and the saturated hydrocarbons under the influence of excited Hg (TAYLOR, HILL) 3. The structure of 3 organic substances (BURGENI, *et al.*) 2. A hydrocarbon model (MÜLLER) 2. Some examples of information obtainable from the long spacings of fatty acids (PIPER) 2. Absorption of ultra-violet light by some purine derivatives and allied substances (MARCHLEWSKI, WIERZUCHOWSKA) 3. Absorption of light by some organic substances (MARCHLEWSKI, WYROBEK) 3. The crystal structure of picric acid (BREDIG, MÖLLER) 2. The thermal behavior of the phenols (HAGEMANN) 2. Electric moments of some substitution products of C_6H_6 and diphenyl (WEISSBERGER, WILLIAMS) 2. The structure of some fundamental aromatic compounds (HENGSTENBERG, MARK) 2. The structure of the C_6H_5 ring in $C_6(CH_3)_6$ (LONSDALE) 2. X-ray evidence on the structure of the C_6H_6 nucleus (LONSDALE) 2. A generalization of stereochemistry (GOLDFINGER) 2. Diffraction of x-rays in liquids: C_6H_6 , cyclohexane and certain of their derivatives (STEWART) 3.

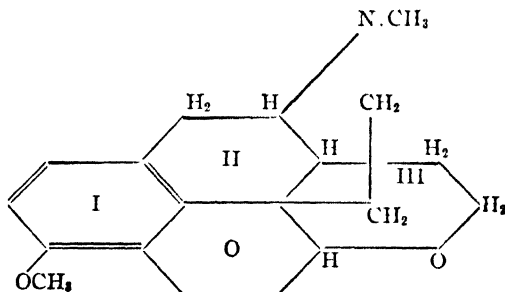
Partial oxidation of gaseous hydrocarbons. HENRY R. CURME (to Carbide & Carbon Chemicals Corp.). U. S. 1,729,711, Oct. 1. Hydrocarbon material such as C_2H_6 or the like contg. a preponderance of normally gaseous paraffins of greater mol. wt. than CH_4 is mixed in excess with an oxidizing gas such as air and the mixt. is heated to above 600° in contact with vitreous material only and under such conditions that CH_2O is formed; the CH_2O produced is sepd. (suitably by condensation) and the mixt. is reheated to obtain an addnl. quantity of CH_2O , etc.

Halogenated anilines. WILLIAM J. HALE and GEORGE H. CHENEY (to Dow Chemical Co.). U. S. 1,729,775, Oct. 1. In forming halogenated arylamines such as *o*-chloroaniline, reaction is effected between anhyd. NH_3 and a polyhalogenated aromatic hydrocarbon such as *o*-dichlorobenzene in the presence of a Cu compd. such as Cu_2Cl_2 .

Ethers of propylene glycol. JOSEPH G. DAVIDSON (to Carbide and Carbon Chemicals Corp.). U. S. 1,730,061, Oct. 1. Monoalkyl ethers of propylene glycol are prepd. under heat and pressure by reaction of Me, Et, iso-Pr, Pr, iso-Bu, Bu and iso-Am alcs. with propylene oxide and the resulting mono-ethers b_{736} , resp., 122.8° , 133° , 141.5° , 150° , 161.3° , 170.6° and 183.3° . Corresponding di-ethers may be prepd. from propylene glycol or from propylene chlorohydrin and a dialkyl sulfate in the presence of NaOH. The pure ethers and their mixts. may be used as solvents for gums, resins and cellulose esters.

Ketones of the anthracene series. ARTHUR LÜTTRINGHAUS and FILIP KACER (to General Aniline Works). U. S. 1,730,081, Oct. 1. α - or β -Anthracyl alkyl ketones are converted into anthraquinonyl alkyl ketones by treatment with oxidizing agents, such as chromic acid dissolved in glacial acetic acid. α - and β -Anthracyl methyl ketone yield α - and β -anthraquinonyl methyl ketone, resp., and 1,5-diacetylanthracene yields 1,5-diacetylanthraquinone. The resulting anthraquinone derivs. may be used as starting materials for the production of dyestuffs. β -Anthraquinonyl methyl ketone m. $140-2^\circ$; 2-propionylanthraquinone m. $138-40^\circ$.

Derivatives of dihydrocodeinone and its substitution products. CLEMENS SCHÖFF (to the firm C. H. Boehringer Sohn). U. S. 1,731,152, Oct. 8. When dihydrocodeinone



or its substitution products or salts thereof, in which ring III contains no hydroxy group, *e. g.*, bromodihydrocodeinone, are subjected to acylation, new acyl derivs. are obtained which contain the acyl residue in ring 3. Acylation is preferably effected by treating the initial material with an excess of org. acid anhydride. By treating dihydrocodeinone with Ac_2O , acetyl dihydrocodeinone is obtained which can be crystd. from alc. in which it is much more sol. than dihydrocodeinone. It m. $154-5^\circ$. The chlorohydrate crystallizes from water in the form of fine needles, m. $132-135^\circ$ with decompn. Also other acylating agents such as acetyl chloride may be used. The methiodide of the butyryldihydrocodeinone crystallizes from alc. in rectangular plates which on heating to 125° froth slightly and m. $220-222^\circ$. The bromohydrate of the butyryldihydrocodeinone m. 225° on being crystd. twice from dil. MeOH. The methiodide of the benzoyldihydrocodeinone, after recrystn. from glacial HOAc and MeOH, m. $240-242^\circ$ with frothing. The bromohydrate of the acetylbromodihydrocodeinone, which can be obtained from water in the form of beautiful crystals, m. $128-132^\circ$. The products, which are probably acyl compds. of the enol form, are stable in the form of salts even when their aq. solns. are boiled for a long period. They are only split up on boiling with concd. acids when the original keto bases are reformed. The compds. are applicable in therapy. Cf. C. A. 23, 4748.

Benzyl mercaptans, etc., for mineral flotation separation, etc. RAYMOND W. HESS and JOSEPH M. F. LEAPER (to Barrett Co.). U. S. 1,729,615, Oct. 1. Production

of benzyl mercaptan is accomplished by reacting a benzyl halide with an alkali metal thiosulfate in an aq. medium and, without isolating from soln. the alkali metal benzyl thiosulfate thus produced, acidifying and heating the resulting reaction mixt. whereby benzyl mercaptan, or a compn. contg. benzyl mercaptan, is formed and pptd. in an impure state as an insol. substance which is subsequently removed from the soln. Details are given of the production of crude benzyl mercaptan, a liquid usually having a more or less yellow color. In general, it contains about 60-75% benzyl mercaptan, 20-35% benzyl disulfide, the remainder consisting mainly of other decompn. products of Na benzyl thiosulfate. It appears to be substantially free from benzyl monosulfide. The benzyl mercaptan may be sepd. from the crude product. The crude or impure product, without purification, is suitable as a flotation agent in the sepn. of minerals and the concentration of ores by flotation.

Butyraldehyde. MARTIN MUGDAN and JOSEPH WIMMER (to Consortium für Elektrochemische Industrie). U. S. 1,730,587, Oct. 8. See Can. 276,824 (C. A. 22, 2573).

Urea. HARRY C. HETHERINGTON and HERBERT J. KRASE (to Arthur B. Lamb, trustee). U. S. 1,730,208, Oct. 1. In producing urea from synthetic NH_3 made from gases contg. CO_2 , N and H, the H and N are sepd. from the CO_2 by use of an aq. soln. of an NH_4 salt as an absorbent, the CO_2 is recovered, the H and N are combined to form NH_3 , the CO_2 and NH_3 are caused to react to form urea and CO_2 present in the unconverted urea synthesis gases is removed in a combined operation with the removal of the CO_2 from the H and N for use in the process. An arrangement of app. is described.

p-Dimethylaminodiphenylguanidine. WINFIELD SCOTT (to Rubber Service Laboratories Co.). U. S. 1,730,388, Oct. 8. Phenyl mustard oil is caused to react with p-aminodimethylaniline to produce a thiourea and the latter is then desulfurized.

p-Dimethylaminophenyl-o-tolylguanidine. WINFIELD SCOTT (to Rubber Service Laboratories Co.). U. S. 1,730,536, Oct. 8. o-Tolyl mustard oil is caused to react with p-aminodimethylaniline to produce a thiourea and the latter is desulfurized.

p-Dimethylaminophenyl-p-phenetidylguanidine. WINFIELD SCOTT (to Rubber Service Laboratories Co.). U. S. 1,730,537, Oct. 8. Phenetidyl mustard oil is caused to react with p-aminodimethylaniline to form a thiourea and the latter is desulfurized.

Chlorosubstituted products of 1-amino-2,4-dimethylbenzene. ERWIN HOFFA, ERNST RUNNE and ERWIN THOMA (to General Aniline Works). U. S. 1,730,729, Oct. 8. When Cl reacts upon a soln. of 1-amino-2,4-dimethylbenzene in concd. H_2SO_4 , the Cl enters in m-position to the amino group and 3-chloro-1-amino-2,4-dimethylbenzene is produced as well as 5-chloro-1-amino-2,4-dimethylbenzene. When the action of the Cl is continued, a second Cl atom easily enters the nucleus with formation of 3,5-dichloro-1-amino-2,4-dimethylbenzene. The 3,5-dichloro deriv. may be sepd. as a sulfate by proper adjustment of the concn. of H_2SO_4 , in which it is but slightly sol. Catalysts such as FeCl_3 , I, etc., may be used in the chlorination, but are not essential. Several examples are given.

11—BIOLOGICAL CHEMISTRY

PAUL E. HOWE

A—GENERAL

FRANK P. UNDERHILL

Does the oxidation quotient of dextrose-free urine change on keeping on account of position? L. CHASKIN and G. NIGMANN. *Biochem. Z.* 205, 473-80(1929).—Rabbit's or human urine kept for 24 hrs. at the ordinary temp. undergoes no change in oxidation quotient. B. C. A.

Iodine as biogenic element. H. EDDÉLBUÏTEL. *Z. physik. chem. Unterricht* 42, 32-42(1929). M. BEBER

The melanin pigments and melanogenesis. R. CORDIER. *Ann. bull. soc. roy. sci. med. Bruxelles* 1928, 43-57.—A review. R. BEUTNER

Viscosity of egg albumin and its variation in fresh and preserved eggs. D. CORTESÉ. *Ann. chim. applicata* 19, 260-5(1929).—The viscosity of egg albumin has been detd. at ordinary temps., fresh and after standing, the viscosity dropping from about 35.0 to 7-8 in 4 weeks. However, with eggs held at 1-2°, this drop in viscosity requires 5 months. A. W. CONTIERI

The mechanism of enzyme action. III. The relation between enzyme action and adsorption. F. F. NORD and J. WEICHERTZ. *Z. physiol. Chem.* 183, 191-217

(1929); cf. *C. A.* 22, 4544.—The influence of the unsatd. hydrocarbons, C_2H_4 , C_2H_2 and C_6H_{10} , on the fermentation of glucose by yeast was studied in a special fermentation app. provided with a dropping funnel, exit tube for CO_2 and mech. stirrer with Hg seal. The hydrocarbon was added in the form of satd. aq. soln. C_2H_2 and C_2H_4 are adsorbed from the liquid medium on the surface of the yeast cells. The initial effect is an external narcosis which inhibits merely the cell metabolism, while the enzymes in the interior maintain their full activity. The gas adsorbed on the surface then diffuses into the cell and by increasing the permeability bring about an increase in performance of the cell. With further penetration into the cell there is an adsorption on the surface of the enzymes present in the interior, resulting in an internal narcosis or inhibition of enzyme action. The activity of the cell is then the resultant of these 3 phases of action, viz., external narcosis, increase in permeability and internal narcosis. At the outset the first of these factors predominates, but as soon as the substance penetrates, the external effect diminishes because of diminishing concn. on the outer surface and increasing permeability. After a time the external narcosis disappears completely and only an increase in cell activity is observed. But this heightened activity is soon counterbalanced by internal narcosis so that an inhibition appears. The strong diffusion of the C_2H_2 or C_2H_4 thus causes a succession of max. action from external narcosis, through permeability increase, to internal narcosis. The greater the concn. employed the more rapid is the penetration into the cell, and consequently the more rapid the succession of the 3 phases of action. It is even possible that the permeability increase may be completely obscured by the rapid onset of internal narcosis. The permeability of bottom yeast is greater than that of top yeast, but on the other hand bottom yeast contains more lipoids. Both C_2H_4 and C_2H_2 are lipid-sol., hence they penetrate bottom yeast much more easily than top yeast. C_2H_4 diffuses more slowly than C_2H_2 since it shows stronger solvation in aq. soln. and is therefore more slowly taken up by the lipid phase of the cell. These facts taken together account for the greater effect of C_2H_2 on both bottom and top yeast. In contrast to its lower homolog, the action of C_6H_{10} is practically independent of the time factor. The velocity with which it diffuses into the cell is extremely small; nevertheless it does penetrate causing a permeability increase, which, however, is obscured by the external narcosis produced by the adsorption layer. Treatment of yeast maceration juice with C_2H_2 or C_2H_4 results in increased surface tension and decreased viscosity. This phenomenon represents a phys. adsorption on the lyophil-colloidal particles, and exerts an inhibiting as well as a protective action. The possibility of almost completely suppressing the activity of enzyme solns. by these substances leads to the inference that the enzymes present in the living cell may also undergo inhibition without actual injury to the cell. **IV. Enzymic processes in germinating barley.** *Ibid.* 218-25. The influence of C_2H_2 and C_2H_4 on germinating barley is similar to that observed with yeast. The germs increase somewhat more rapidly in length; the diastatic power develops at a higher rate and the liberation of amino acids reaches a greater max. In the first few days the yield of green malt is somewhat higher in the control, but after the 10th day the treated seedlings show a smaller loss on drying. These effects are greater with C_2H_2 than with C_2H_4 . There is no evidence of any chem. reaction with the adsorbed gas. The effects are attributed to an increased permeability of the cells. The green malt when dried and stored in the absence of air develops $AcOEt$; this is due probably to a mutase which brings about a Cannizzaro reaction of the AcH and a lipase which esterifies the products.

A. W. DOX

Aging of hydroxyhemin on drying. A. HAMSÍK. *Z. physiol. Chem.* 183, 269-72 (1929).—Freshly prepd. hydroxyhemin while still moist reacts readily with 80% CH_2O_2 to yield crystals of the formyl deriv. After drying several days in the air the same hydroxyhemin preps. react much less readily. The activity may be restored by dissolving in MeOH contg. KOH and acidifying. The loss of activity by simple drying is explained by the formation of anhydride. Pure hydroxyhemin probably exists only in the moist condition.

A. W. DOX

The specificity of peptidases. III. Affinity measurements with animal dipeptidase. ERNST WALDSCHMIDT-LEITZ and GUSTAV V. SCHUCKMANN. *Z. physiol. Chem.* 184, 56-68 (1929); cf. *C. A.* 22, 2381. —For affinity measurements glycyl-L-tyrosine has advantages over glycylglycine in that it is more sol. and shows greater affinity for the enzyme. The cryst. substance should be used, since the amorphous product contains impurities which strongly inhibit the reaction. These measurements were undertaken for the purpose of ascertaining the nature of the influence of H ions on the reaction velocity, and the probable identity of dipeptidase from different sources, e. g., from secretions and from organs. It is shown that the dissocn. of the enzyme-peptide compd. is

strongly influenced by H-ion concn. The form of the activity p_H curve is detd. primarily by the location of equil. between enzyme and substrate, if not by the formation velocity of enzyme-substrate compd., not, however, by the decompn. velocity. A comparison of the affinity of 3 animal dipeptidases, from enteric mucosa, pancreas and spleen, resp., at the p_H optimum of 7.8, gave the same dissoen. const. for all 3, viz., $K_s = 0.0026$. This agreement in affinity points to an identity or at least to a close relationship of the chemically active groups in the enzymes. However, the recent work of Linderstrøm-Lang (C. A. 23, 3718) must be considered, where the existence of 2 dipeptidases appears probable.

A. W. DOX

The cleavage of glycylglycine, alanylglycine and leucylglycine by intestinal and malt peptidases. K. LINDERSTRØM-LANG AND MASAKAZU SATO. *Z. physiol. Chem.* 184, 83-92(1929); cf. C. A. 23, 3718.—Intestinal mucosa contains 2 dipeptidases which differ in their p_H optimum, specificity, stability and behavior toward $Al(OH)_3$. Dipeptidase I has its optimum at p_H 7.3, is very unstable in aq. soln., and hydrolyzes leucylglycine and glycylglycine with about the same velocity. Peptidase II has its p_H optimum at 8.1, is stable in aq. soln. and splits leucylglycine with much greater velocity than glycylglycine. The cleavage of leucylglycine and that of alanylglycine bear the ratio of 1.8 for peptidase I, and of 5.1 for peptidase II at their p_H optima. Two enzyme solns. with equal activity toward leucylglycine may thus show a ratio of 1.40 when tested with alanylglycine. Malt ext. also contains 2 peptidases. The first rapidly undergoes destruction in aq. soln. after removal of proteinase by $Fe(OH)_3$. The aq. soln. when tested was 4 times as active toward leucylglycine as toward alanylglycine and practically inert toward glycylglycine. A glycerol ext. of the same malt, however, retained its peptidase I activity and was therefore a mixt. of I and II. It hydrolyzed alanylglycine twice as rapidly as leucylglycine and gave a distinct cleavage of glycylglycine. The p_H optima for the 2 malt peptidases are 7.8 and 8.6. Malt peptidase II attacks also the tripeptide leucylglycylglycine.

A. W. DOX

Plant proteases. XIV. Proteases of higher plants. OTTO AMBROS AND ANNA HARTENECK. *Z. physiol. Chem.* 184, 93-107(1929); cf. C. A. 23, 2726.—The 2 types of plant proteases, represented by papain which is activated by HCN and pumpkin protease which is inhibited by HCN, occur together in various plants. The gradations observed in activation or inhibition by HCN are due to differences in the relative proportions in which the 2 enzymes are present. Fruit juices which under ordinary exptl. conditions are activated by HCN may suddenly show strong inhibition if the expt. is continued over a longer period. It appears that an enzyme is present which is inhibitable by HCN, but being specific for protein cleavage products its presence is not observed until suitable substrates are provided by the proteinase action. This enzyme is shown to be a dipeptidase, the activity of which is inhibited by HCN. It occurs in all the plants examd. and in all parts of the plant with the exception of the latex. Its p_H optimum for alanylglycine is at 7.6, and it closely resembles the dipeptidase of yeast and of animal intestine. The protease system of plants thus consists of a proteinase (papain) and a dipeptidase; the 1st is activated and the 2nd inhibited by HCN.

A. W. DOX

Experimental demonstration of the law of cytoplasmic sexualization. PH. JOYET-LAVERGNE. *Compt. rend.* 189, 409-12(1929); cf. C. A. 21, 1290, 2001.—The study of the disturbances caused by a deficiency in vitamin B gives a true exptl. demonstration of the law of cytoplasmic sexualization.

LOUISE KELLEY

Crystalline tripeptide from living cells. F. GOWLAND HOPKINS. *Nature* 124, 445(1926).—A cryst. tripeptide contg. glycine, glutamic acid and cysteine has been isolated from cell exts., e. g., from exts. of yeast and red blood corpuscles. The isolation of this pure substance indicates that "glutathione," as previously described by H., is not an individualized substance.

LOUISE KELLEY

Rhythmic sedimentation of erythrocyte suspensions. V. DUCCESCHI. *Kolloid-Z.* 48, 78-9(1929).—When blood serum is treated with an isotonic soln. the red corpuscles coagulate on the walls of the vessel in rhythmic formation. The blood of the dog, man, rabbit, horse, hog and ox was studied. No explanation has as yet been found for this phys. phenomenon.

R. H. LAMBERT

The solution, by the action of neutral salts, of albumin coagulum, with restored ability to be coagulated. R. WILLHEIM. *Kolloid-Z.* 48, 217-31(1929).—Albumin coagulated by heat is redissolved at the boiling temp. by addn. of such salts as $KSCN$, Na salicylate, Na benzoate, etc. On removal of the salt by dialysis the albumin again becomes coagulable. To produce this phenomenon there is necessary a certain min. salt concn. and a quantity of liquid depending on the quantity of coagulum. This is explained by assuming that the solution takes place in 2 phases. The various anions follow the Hofmeister series in their effectiveness. The phenomenon is directly con-

nected with the swelling of the protein. The effect of these salts on viscosity of protein solns. is very small and the change is not a const. increase except at the boiling temp. There a smooth curve results showing a max. due to a change in degree of dispersion of particles. Repeated heating to the b. p. tends to decrease osmotic pressure.

R. H. LAMBERT

Sulfur in proteins. IV. The effect of alkalis upon cystine. ROSS A. GORTNER AND WALTON D. SINCLAIR. *J. Biol. Chem.* 83, 681-96(1929); cf. *C. A.* 21, 3184.—Boiling cystine with 1 or 5% Na_2CO_3 soln. decomposes about $\frac{1}{2}$ the cystine in 24 hrs. In a 6.5% soln. of $\text{Ba}(\text{OH})_2 \cdot 8\text{H}_2\text{O}$ approx. 50% of the cystine is destroyed in 1 hr. of boiling, the N being liberated as NH_3 and the S as sulfide S. After 24 hrs. there still remains approx. 15% of the bound amino N and an equiv. amt of bound S. With 20% NaOH or KOH 83% of the original N is still present as α -amino N after boiling for 24 hrs. These solns. cause rapid and complete removal of the S. Rapid deamination is produced by 6% $\text{Sr}(\text{OH})_2$ soln. and a 5% suspension of $\text{Ca}(\text{OH})_2$. With the latter the deamination reaches 92% in 12 hrs. The rate and extent of deamination does not appear to be a function of the OH-ion concn. of the alk. soln. "There appears to be an intimate relationship between the deamination mechanism and the rate at which S is removed. It is suggested that deamination of cystine in alk. soln. may be assocd. with an oxidation-reduction mechanism and that when all, or nearly all, of the S has been removed then the α -amino groups which still remain become relatively stable. Cystine, or some org. compd. having essentially the same N S ratio as cystine, still persists in the soln. after 24 hrs. of boiling with 6.5% $\text{Ba}(\text{OH})_2$ soln. It is suggested that this 'compd.' may be another 'isomeric' form of cystine, differentiated from it by the fact that it is extremely sol. in H_2O , so sol. in fact as to be hydrosopic." Attempts were made to isolate pure org. compds. from the decompn. products but there is a great complexity of compds. produced which contain "loosely-bound" org. S even after boiling cystine with $\text{Ba}(\text{OH})_2$ soln. for 24 hrs. *l*-Cystine and *i*-cystine are decompd. at the same rate and to the same extent.

A. P. LOTHROP

Studies on lactic acid fermentation of warm-blooded tissues. II. Effect of potassium and calcium ions on the occurrence of extra fermentation of rat salivary gland and liver tissues. OTTO ROSENTHAL. *Biochem. Z.* 211, 295-322(1929); cf. *C. A.* 23, 3241.—Both K and Ca ions produce a similar effect in increasing the lactic acid fermentation of tissues, the extra fermentation under aerobic conditions either not occurring or being considerably reduced in the absence of these ions. The only difference is in the degree of action, the Ca ion having a greater influence than the K ion in the liver but not in the salivary gland tissue.

S. MORGULIS

Studies on the structure of silk fibroin. EMIL ADDERHALDEN AND HANS BROCKMANN. *Biochem. Z.* 211, 395-411(1929)—In a dispersion of silk fibroin in a concd. soln. of LiBr the dispersed particles do not change in size with time. From 6.9 to 8.7% of the dispersed protein passes to the outside fluid in dialysis. Although the fibroin soln. can be pptd. with different concns of $(\text{NH}_4)_2\text{SO}_4$ it was not possible by this method to sep. fractions with specific characteristics. The introduction of benzoyl, *p*-bromobenzoyl or *p*-chlorobenzoyl groups indicating a combination with OH groups proves the existence in the free state of serine and tyrosine in the fibroin mol.

S. MORGULIS

Urine adialyzate. H. PRIBRAM. *Biochem. Z.* 211, 412-9(1929).—Urine is dialyzed in a collodion bag either against H_2O or 0.1 N HCl. The adialyzate (non-dialyzed residue) consists of a ppt. and a water-sol. fraction which can be pptd. with an alc.-ether mixt. (2:1). By repeated soln. and pptn. with alc.-ether mixt. the adialyzate can be prepd. very poor in salt content. The adialyzate corresponding to 16-cc. urine per kg. injected into rabbits produced miosis lasting an hr., while that corresponding to 59-cc. urine caused the animal to lie on its side. The active substance is precipitable through $(\text{NH}_4)_2\text{SO}_4$. Preliminary administration of sugar shortens the action of the adialyzate. On the guinea pig uterus the effect is produced only by very large doses and this is probably due to the salts.

S. MORGULIS

The non-specificity of the proteolytic organ enzymes. K. UTKIN-LYUBOVITZOVA AND O. STREPPUN. *Biochem. Z.* 211, 426-44(1929).—In all tissues of a single species it was found that 3 proteolytic enzymes may be differentiated by their optima at *pH* 3.4, 5.4 and 7.4, resp. The same mixt. of proteolytic enzymes was observed in the rabbit liver. The hypothesis of the specificity of the proteolytic enzymes of organs fails therefore to obtain exptl. corroboration.

S. MORGULIS

The lipolytic activity of saliva. B. KOLDAVEV AND PIKUL. *Biochem. Z.* 212, 53-9(1929).—Saliva from the parotid and submaxillary glands of dogs by means of Pawlow fistulas has definite lipolytic action on synthetic fats as well as on natural fats (olive oil). The lipolytic action of the parotid is greater than that of the submaxillary,

and disappears when the saliva is boiled. The opt. lipolytic activity is at p_H 7.6-7.8, and is independent of the amylolytic activity of the saliva. The lipolytic activity is about the same in saliva obtained through stimulation by various foods, but parotid saliva obtained with dil. HCl does not hydrolyze fat. S. MORGULIS

Tryptoporphyrin. GABRIELE MONASTERIO. *Biochem. Z.* 212, 71-9(1929).—On prolonged digestion in alk. medium with trypsin or pancreatin, hematin is very largely changed to an Fe-free substance with disruption of the mol., in other words into a tryptoporphyrin. A small portion retains its Fe content with great tenacity, and none of the methods for removing Fe from hematin meet with success here. On the contrary, these reagents may actually destroy the bulk of the substance without detaching the Fe, thus leading to the formation of a product nearly as rich in Fe as hemin but not possessing its spectral properties. This suggests that a part of the Fe in hemoglobin must be in loose and a small part in fixed combination. S. MORGULIS

The metabolic effects of mitogenetic radiations. HEINRICH GESENTUS. *Biochem. Z.* 212, 240(1929).—The effect of mitogenetic radiations was studied on *Saccharomyces ellipsoideus* as detector. It was found that their fermentation metabolism was raised 8.8% in 79 expts. An increase was observed in 80% of the tests, a decrease in 1% and in 19% no change occurred. The expts. were made with Warburg's app in a N_2 atm., a 5% glucose soln. of p_H 5.7 being used. The respiratory metabolism under the influence of the mitogenetic radiations was diminished 17% in 75% of the expts. S. MORGULIS

The sulfur content of different serum globulins. ZOLTÁN ASZÓDI. *Biochem. Z.* 212, 102-14(1929).—The S content of globulins from individuals of the same species shows considerable variation. The range of variation found in different subjects was as follows: man 1.06-1.38%; pig 0.97-1.32%; cow 1.17-1.33%; horse 1.03-1.27% and dog 1.17-1.60%. Values above 1.30% are rare in the serum globulin of the various organisms studied except the dog where this is more or less the usual magnitude. S. MORGULIS

The sulfur content of fibrin from different mammals. ZOLTÁN ASZÓDI. *Biochem. Z.* 212, 158-61(1929).—The % of S in fibrin from human blood is 1.28-1.44; from pig 1.07-1.09; cow 1.20-1.27; horse 1.16-1.20 and dog 1.24-1.42. S. MORGULIS

New knowledge of the specificity and mode of action of sugar-splitting enzymes. RUDOLF WEIDENHAGEN. *Z. angew. Chem.* 42, 833-5(1929).—Further discussion (cf. C. A. 23, 3237). CORNELIA T. SNELL

Colloids as regulators of the division energy of cells. G. L. ROHDENBURG. *J. Cancer Research* 13, 242-50(1929).—Colloids of various kinds (aq. suspensions of lecithin, cholesterol, egg albumin, acacia and gelatin) inhibit the division energy of paramaecia to a varying degree when added to hay infusion. H. G. WELLS

Effects of cathode rays on the proteins of serum. LILLIAN E. BAKER AND ROBERT B. COREY. *J. Exptl. Med.* 50, 439-44(1929).—The effects of cathode rays on the proteins of serum appear to be (1) denaturation of a large proportion of the albumin and globulin with the formation of products that are sol. at the p_H of the serum; (2) the production of a tough and exceedingly insol. substance on the window of the cell where most of the absorption of electrons occurs; (3) a slight hydrolytic cleavage of the protein mol. producing a small quantity of products having properties so near those of the protein that they are pptd. by Cl_3CCO_2H but are not removed by coagulation at the isoelectric pt.; (4) the production of a small quantity of hydrolytic products not pptd. by Cl_3CCO_2H and (5) the formation of a small amt. of NH_3 , part of which at least is derived from the $CO(NH_2)_2$ of the serum. These changes are such as would bring about exactly those effects on fibroblasts which were observed when cultures were grown in serum which had been subjected to cathode ray irradiation. C. J. WEST

Cell proliferation response to sulfhydryl in mammals. F. S. HAMMETT AND S. P. REIMANN. *J. Exptl. Med.* 50, 445-8(1929).—Studies with thioglucose establish that the SH group is stimulative of cell proliferation in mammals as in the lower organisms. The fact that the stimulation is exhibited in such a wide diversity of species including both plants and animals is justification for the belief that it is the expression of a fundamental biol. phenomenon. C. J. WEST

The problem of pigment formation. BRUNO BLOCH. *Am. J. Med. Sci.* 177, 609-18(1929).—The specific dopa reaction is pos. in the melanoblasts of higher vertebrates. There is a time, place and intensity parallelism between the reaction and the formation of pigment. The agent within the cells which is responsible for the reaction has the characteristics of an oxidizing enzyme and is concluded to be identical with the natural pigment producing oxidase, thus being called dopa oxidase. The mother sub-

stances of melanogens is indefinite but it is indicated that pyrocatechin derivs. play a role in the formation of natural pigment. R. C. WILLSON

The nomenclature of lipides (VESELÝ, JAKŠ, 2). The relation between the sizes of ions and the salting-out of hydroquinone and quinone (LINDERSTRØM-LANG, 2). Wo. Ostwald's "solid-phase rule" and the solubility of casein in NaOH (SØRENSEN, SLÁDEK, 2). Dielectric polarization of ovalbumin solutions (GARREAU, MARINESCO, 2).

B--METHODS AND APPARATUS

STANLEY R. BENEDICT

Nuclear staining in the dry blood preparation. G. C. VAN WALSEM. *Nederland. Tijdschr. Geneeskunde* 73, I, 532-5(1929). W. recommends a special method of fixation of blood preps., using CH_3OH and CHCl_3 and 1.66% Azure 1 + 10% NaOH for staining. R. BEUTNER

The cleaning of glassware used for morphological blood examination. G. C. VAN WALSEM. *Nederland. Tijdschr. Geneeskunde* 73, II, 3258-60(1929). W. recommends Br_2 dissolved in NaOH. R. BEUTNER

The unreliability of Nylander's reaction in a strongly acid urine. W. HOOGLAAG. *Nederland. Tijdschr. Geneeskunde* 73, II, 1377(1929). KOH must be added to acid urine for detecting sugar by Nylander's reagent. R. BEUTNER

Practical experience with potentiometric and colorimetric pH methods in serum. H. SCHREUS AND K. SCHULZE. *Z. ges. exp. Med.* 64, 540-52(1929). F. L. DUNN

The use of tungstomolybdic acid as a precipitant for blood proteins. STANLEY R. BENEDICT AND ELEANOR B. NEWTON. *J. Biol. Chem.* 83, 357-60(1929); cf. C. A. 23, 2733. A protein precipitant is described which does not cause the loss of any non-protein constituents and which thus permits the quantitative recovery of thionine and glutathione from blood. It is prepd. and used as follows: 10 g. of pure, NH_4 free molybdic acid is treated in a flask with 50 cc. of N NaOH and the mixt. boiled for 1 to 2 min. A practically clear soln. should result. About 150 cc. of H_2O is added and the cooled soln. is mixed with a soln. of 80 g. Na_2WO_4 dissolved in about 600 cc. H_2O . This mixed soln. is dild. to 1:1. The acid employed during the pptn. is 0.62 $\text{N H}_2\text{SO}_4$, prepd. by dild. 620 cc. of N acid to 1:1. The pptn. of blood proteins is carried out as in the familiar tungstic acid pptn. ARTHUR GROLLMAN

Studies on the non-sugar reducing substances of the blood and urine. 1. Glutathione and thionine in blood. STANLEY R. BENEDICT AND ELEANOR B. NEWTON. *J. Biol. Chem.* 83, 361-5(1929). A procedure is described for isolating glutathione from sheep blood which is superior to yeast for this purpose. Glutathione is responsible for a large proportion of the non-sugar reduction yielded by blood. A. G.

A simple determination of acetoacetic acid in urine. J. MILKA AND F. KLEIN. *Bratislav. Lekárske Listy* 8, 188-92(1928). The acetoacetic acid in 5 cc. urine is decompd. by the addn. of 12 drops of $\text{N H}_2\text{SO}_4$ and heating in a water bath for 15 min. After cooling and making alk. with NaOH, FeCl_3 soln. is added and sufficient 1% soln. of acetoacetic acid to give a color reaction of the same intensity as that obtained from the original sample of urine. The amt. of acetoacetic acid added is equal to that originally present. WILLIAM J. HUSA

Basic amino acids. The estimation of the basic amino acids in small amounts of casein and edestin by the modified method of Vickery and Leavenworth and other methods. H. O. CALVERY. *J. Biol. Chem.* 83, 631-48(1929). The modified method of Vickery and Leavenworth for the estn. of the basic amino acids of protein (C. A. 22, 1606) has been further modified for use on small quantities of protein. Very consistent results have been obtained when casein and edestin were analyzed by this modification. The histidine and arginine contents of casein were also estd. by other methods for comparison. The total N of the arginine fraction is not a true indication of the amt. present. The alk. hydrolysis method of Van Slyke (C. A. 6, 236) is probably a true indication and the isolation method gives values which correspond to those obtained by alk. hydrolysis. The colorimetric method of Hanke and Koesler (C. A. 14, 3687) and the bromination method of Plimmer and Phillips (C. A. 18, 2015) give values which agree well with those obtained for the total N of the histidine fraction. The latter method is accurate only under very special conditions and is influenced especially by temp. and also by the acid concn., and the length of time of bromination and there are several interfering substances. The soly. of the Hg compd. of histidine is markedly influenced by acid concn., since it will not ppt. from an H_2SO_4 soln. more concd. than 13% by wt., it is almost quantitatively pptd. when the acid concn. is between 3 and 5%. A. P. LOTROP

The determination of p_H and carbon dioxide on a single small sample of blood plasma or serum. ALFRED T. SHOHL. *J. Biol. Chem.* 83, 759-63(1929).—When economy of blood is necessary, the method described allows a detn. of both the CO_2 and p_H on 0.1 to 0.2 cc. of blood serum or plasma. The p_H is measured colorimetrically in 0.9% NaCl and the material is then transferred without exposure to air to the Van Slyke gas app. for the detn. of CO_2 . A. P. LOTHROP

A micro electrode and vessel for the determination of the hydrogen-ion concentration of blood media, whole blood and other biological fluids. A. J. SALLE. *J. Biol. Chem.* 83, 765-72(1929).—The micro electrode and vessel described for the detn. of the H-ion concn. of blood and other biol. fluids is so constructed that a min. of contact is automatically obtained between the fluid and electrode. With the aid of a push button operated by the foot, readings are practically instantaneous before there is any appreciable loss in the concn. of CO_2 and O_2 . The results agree very closely with those obtained with the colorimetric method. A. P. LOTHROP

The modern methods of bilirubimetry in blood. NOEL FIESSINGER AND HENRY WALTER. *Ann. méd.* 23, 178-201(1928). The methods of different authors for detn. of bilirubin in blood are described, criticized and the indications for the detn. are explained. A. E. MEYER

A protein sulfuric acid ester in the liver. SIGMUND FRÄNKEL AND GABRIELE MONASTERIO. *Biochem. Z.* 211, 264-9(1929). Freshly pulped liver is rubbed up with an equal wt. of H_2O and 40 cc. N AcOH, filtered or centrifuged, and the ext. warmed to 60-70°. The cooled filtrate is pptd. with CCl_3CO_2H until a turbidity is no longer formed and then filtered. The filtrate is neutralized with $PbCO_3$, condensed *in vacuo* and freed of Pb with H_2S . The H_2S is driven off by CO_2 and the filtrate is pptd. with double the vol. of alc. The filtrate is reduced to a small vol. *in vacuo* and dialyzed against H_2O until the H_2O no longer gives a test for acid. The non-dialyzed residue is very much concd., pptd. with twice the vol. of alc. and the filtrate, again reduced to small vol. *in vacuo*, is once more pptd. with an excess of alc. A white powder is pptd. which is washed with 95% and then with abs. alc., finally with ether, and dried *in vacuo*. S. M.

Determination of creatine and creatinine in small quantities of blood. E. KOPLOWITZ. *Biochem. Z.* 211, 475-86(1929). Serum or laked whole blood is deproteinized with CCl_3CO_2H and centrifuged. To an aliquot portion of the clear soln. a drop of p -nitrophenol and a few drops of 33% NaOH are added until yellow color appears. For the creatine detn. the soln. (- 1 cc. serum, or 0.83 cc. blood) is treated with enough 6 N HCl to give a final concn. of 2 N and this is left for 24 hrs. at 60-65°, when all the creatine is converted to creatinine. The creatinine is detd. colorimetrically by adding 5 cc. of a mixt. of 25 cc. satd. picric acid with 10 cc. 3% NaOH, and matching the color after letting it stand 30 min. No difference was found in the creatine or creatinine content of venous and arterial bloods. S. MORGULIS

Microchemical determination of calcium in serum and plasma. B. GROÁK. *Biochem. Z.* 212, 47-52(1929). By modifying the detn. of CaC_2O_4 into an iodometric titration the accuracy of the method has been extended to 0.0002 mg. Ca. A tenth of a cc. of blood is measured by means of a capillary pipet into a small tube, the pipet is rinsed with 0.1 cc. H_2O and finally 0.3 cc. $(NH_4)_2C_2O_4$ is added and the tubes are left for 2 hrs. After centrifuging 15-20 min. the liquid is removed by means of a siphon and the ppt. is washed 3 times with 0.5 cc. 2% NH_4OH and centrifuged 2-3 min. To the ppt. is added 0.2 cc. 20% H_2SO_4 and this is heated in boiling water. One cc. 0.002 N $KMnO_4$ accurately measured is introduced into the tube and after 2-3 min. cooled. Now 0.1 cc. 10% KI and 1 drop starch soln. are added and the liberated I_2 is titrated with 0.001 N $Na_2S_2O_3$, one cc. of which corresponds to 0.02 mg. Ca. In the calcn. of the results the $\{[cc. Na_2S_2O_3 \text{ of the blank}] - [cc. Na_2S_2O_3 \text{ in analysis}]\} \times Na_2S_2O_3 \text{ factor} \times 20 = \text{mg. } \% \text{ Ca.}$ S. MORGULIS

The so-called vitamin A reactions. GABRIELE MONASTERIO. *Biochem. Z.* 212, 66-70(1929). Cod-liver oil gives pos. tests with $AsCl_3$, $SbCl_3$, P_2O_5 , H_2SO_4 , pyrogallol and resorcinol. The residue from an alc. ext. of cod-liver oil gives a pos. pyrogallol and resorcinol test, doubtful test with $AsCl_3$ and all other tests neg. The cod-liver oil after the alc. extn. gives strong reactions with all tests. After heating the cod-liver oil in an air stream at 150°, which destroys its biol. action, all the reactions disappear except the pyrogallol and the resorcinol tests which still remain strongly pos. S. MORGULIS

A simple apparatus for the determination of the alkali reserve of the blood. MAX SCHLESINGER. *Biochem. Z.* 212, 115-26(1929).—The app. consists of a vessel 6×13 cm. which communicates with a 25 cm. calibrated capillary tube of 0.02-0.03 sq. cm. cross section. The cross section is detd. by weighing the Hg corresponding to 1 cm. and multiplying this by the factor of sp. vol. at 20° (0.0738). The open end of the vessel

can be closed by means of a ground-glass plate. A drop of octyl alc., 0.8-cc. H_2O and 0.5-cc. paraffin oil are introduced into the vessel and 1-cc. plasma is measured under the surface of the liquid, followed by 0.2 cc. 6 vol. % H_2SO_4 , and the vessel is closed. As soon as the Hg in the capillary ceases to rise a reading is taken and the app. is shaken for several min. and the height of the capillary column is again read. The difference multiplied by the vessel constant for the temp. of the expt. gives the total CO_2 in 100 cc. plasma. Tables for the calcn. are given. The results agree very well with those obtained by means of the Van Slyke method. S. MORGULIS

The physico-chemical conditions for the disinfection of urine. J. KLERBERG. *Zentr. Bakt. Parasitenk.*, I Abt., 112, 382-5(1929).—Urotropine at a diln. of 1:500 inhibited growth below a p_H of 6.9, and helmitol below 7.3. JOHN T. MYERS

A new chart illustrating results in the analyses of urines. J. DÉCADE. *J. pharm. chim.* [8], 9, 259-60(1929).—See C. A. 23, 4958. S. W.

X-ray contrast media. BERNARD FANTUS. *J. Am. Pharm. Assoc.* 18, 231-7(1929).—A discussion of present knowledge with reference to diagnostic value in medicine. L. E. WARREN

Spectrographic chemical analysis (RAMAGE) 7.

C—BACTERIOLOGY

CHARLES B. MORREY

A systematic study of some torulae. F. C. HARRISON. *Trans. Roy. Soc. Can.* 22, Sect. V, 187-225(1928).—H. gives a systematic study of a large number of torulae, including their actions on mono- and disaccharides, milk and other substrates. A. T. CAMERON

A study of some types of bacteria which produce a "caramel" flavor in milk. C. D. KELLY. *Trans. Roy. Soc. Can.* 22, Sect. V, 227-32(1928).—Four strains of bacteria were isolated from samples of milk rejected at a large British Columbia milk plant for having a cooked flavor. These are temporarily classified as variants of *Streptococcus lactis*. A. T. CAMERON

Fermentation and growth in dried yeast cells. II. CHR. BARTHEL, H. v. EULER AND K. MYRBÄCK. *Z. physiol. Chem.* 183, 237-43(1929); cf. C. A. 21, 597.—An air-dried bottom yeast which had retained 65% of the fermenting power of the fresh yeast from which it was prepd. was subjected to further treatment with H_2O , H_2O and CH_3Cl , and then allowed to ferment sterile beerwort to which had been added 4% glucose and small quantities of phosphate and zymophosphate. Counts were made of the total no. of cells and of the no. of living cells as represented by colonies developed on wort-agar plates, both at the beginning and at the end of the expt. During the 48-hr. fermentation the proportion of living cells had increased from 1/140,000 to 1/11,500, an entirely normal increase. The yield of CO_2 was 65% of that produced by the original fresh yeast. Calcd. from these data, the fermentation attributable to living cells would be 1/90,000 of the total at the beginning and 1/7500 at the end of the expt. More than 99.98% of the fermentation caused by this highly active dried yeast must therefore have been due to cells incapable of reproduction. A. W. DOX

Physiological characteristics shown by *Sterigmatocystis nigra* in the absence of zinc and iron. MARIN MOLLIARD. *Compt. rend.* 189, 417-20(1929).—From his expts. M. concludes that either it is impossible by the method used, to remove all the Fe and Zn from the medium, or these metals are not absolutely indispensable in the development of *Sterigmatocystis nigra*, their absence merely modifying the rapidity of the nutritive change. LOUISE KELLEY

The cytology and microchemistry of *Mycobacterium tuberculosis*. GEORGES KNAYSI. *J. Infectious Diseases* 45, 13-33(1929).—A microchem. study of young tubercle bacilli does not substantiate the assumption of a wax or fat sheath around the cell of the tubercle bacillus, or of wax or fat granules inside the cell. The literature on the chemistry and structure of the tubercle bacillus is reviewed. JULIAN H. LEWIS

Pathogenicity and proteolytic action of typhoid bacilli. J. WEISSFELDER. *Z. Immunitäts.* 58, 193-201(1928).—Typhoid bacilli possess an enzyme which can digest blood serum. The toxic substances which are present in typhoid culture fluids are apparently disintegration products of protein. Toxic substances are found in the blood, urine and serous fluids of typhoid patients and infected animals which arise from the proteins of the body and are identical in their action to the toxic material in culture fluids. Animals immunized against typhoid bacilli are nevertheless sensitive to this toxic action. Various strains of typhoid bacilli can be distinguished by their proteolytic strength and the stronger the proteolytic action the more virulent they are. J. H. L.

The morphology and biochemistry of the variants of proteus X 19 and its toxin. M. STUTZER. *Z. Immunitäts.* 58, 202-21(1928).—The O and H forms of the proteus bacillus X 19 can be differentiated by their metabolism, their toxic action and immunologically.

JULIAN H. LEWIS

The toxicity of mannitol-fermenting dysentery bacilli. A. DE ASSIS. *Z. Immunitäts.* 58, 343-53(1928).—Filtrates of bouillon cultures and autolyzates of Y-dysentery bacilli were not toxic for white mice, although the dried bacteria and the concd. fluid in which the organisms were heated were toxic. Neither normal nor immune horse serum neutralized this toxic effect. Toxicity of Y-dysentery bacilli, therefore, depends on a substance arising from the bacterial substance and is not a true toxin.

JULIAN H. LEWIS

The biology of the staphylococcus. HANS GROSS. *Z. Immunitäts.* 59, 510-6 (1928).—The most important products of staphylococcus growth are a hemolysin, leucotoxin, a tryptic enzyme, gelatinase, a rennin and staphylokinase. Certain strains of pyocyanus produce a toxin which can be demonstrated by intracutaneous injection into rabbits and guinea pigs.

JULIAN H. LEWIS

The chemical study of bacteria. XXIX. A proximate analysis of a defatted residue of avian tubercle bacilli. ALICE G. RENFREW. *J. Biol. Chem.* 83, 569-77(1929); cf. *C. A.* 23, 407.—The defatted avian residue has been subjected to extn. with H₂O, NaCl soln. and 0.5% NaOH and protein and carbohydrate material comparable to that already isolated from the human strain together with certain lipid fractions and the protein extd. by 0.5% NaOH have been isolated for biol. testing. The yields of the carbohydrate and of the alk.-sol. protein are low in comparison with similar fractions from the human strain. Further quantities of a waxy lipid have been obtained from avian and human strains after acid treatment of residues which had previously been thoroughly extd. with fat solvents.

A. P. LOTHROP

Luminous bacteria. SAMUEL E. HILL AND CHARLES S. SHOUP. *J. Bact.* 18, 95-9(1929).—Luminous bacteria grow and luminesce best on alk. media, pH 8.0. BaCO₃ is toxic and MgCO₃ apparently stimulating to them. They do not produce indole. They liquefy gelatin. They produce acid from glycerol and dextrose but luminesce very little on dextrose. No growth or luminescence occurs in the presence of pure H but they regain this power after being thus sealed for 14 months. Similar results occur with pure N, luminescence being regained after 12 months.

JOHN T. MYERS

The fermentation of glucuronic acid by certain bacteria. ARMAND J. QUICK AND MORTON C. KAHN. *J. Bact.* 18, 133-7(1929).—The members of the colon-typhoid-dysentery group can utilize glucuronic acid as a source of energy. Four strains of *Staphylococcus aureus* did not use it, and one strain of *Staph. albus* fermented it. Most anaerobic spore formers can utilize it if they ferment glucose, but less energetically; and also a few strains which do not ferment glucose. Much work remains to be done before it can be used for identification.

JOHN T. MYERS

The specificity of scarlatinal hemolytic streptococci, with special reference to the formation of rash-developing substances. GEORGE MORIWAKI. *J. Bact.* 18, 139-56 (1929).—Injections of toxins of non-scarlatinal hemolytic streptococci in a pos. reactor can turn Dick's skin reaction to neg. Scarlatinal streptococci are those strains of hemolytic streptococci which have a stronger tendency to develop rash in the human, and stronger antigens for the blanching phenomenon.

JOHN T. MYERS

The influence of *Azotobacter chroococcum* upon the physiological activities of cellulose destroyers. J. R. SANBORN AND W. B. HAMILTON. *J. Bact.* 18, 169-73 (1929).—*Azotobacter* produces a gum which is a carbohydrate, levorotatory, and not readily hydrolyzed by boiling with acid. It contains a trace of combined N. Under certain conditions *Azotobacter* assumes a form in which the cell membrane assumes a diffuent or mucilaginous character. *Azotobacter* gum may aid the action of cellulose destroyers.

JOHN T. MYERS

Bile blood agar as a differential medium for streptococci. D. E. BELENKY AND N. Y. POPOVA. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 22-7(1929).—The method is useful.

JOHN T. MYERS

The morphological and biochemical changes in *Bact. lepra* Kedrowski under the influence of radium emanation. ANNA ZOLKEVICH. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 67-71(1929).

JOHN T. MYERS

The influence of oxygen on form and motility of the cholera vibrio. M. VAN RIEMSDIJK. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 161-89(1929).—Hanging drops from the surface scum of a 24 hr. cholera vibrio culture were compared with drops made from the depths away from O, for 20 days. Those from the surface were shorter and plumper;

they lose their motility, autoagglutinate and develop involution forms much more quickly. JOHN T. MYERS

The influence of capillary-active substances on the growth of the tubercle bacillus. L. MODEL. *Zentr. Bakt. Parasitenk.*, 1 Abt., 113, 214-9(1929) — Capillary-active substances are those which decrease surface tension. The ratio of inactive suspensoids to such substances gives a quotient which expresses at least a factor in the dynamics of infection. JOHN T. MYERS

The Gram-positive character of pneumococci and diphtheria bacilli. W. WILKE. *Zentr. Bakt. Parasitenk.*, 1 Abt., 113, 262-6(1929). — Sp. immune serum has no effect on the Gram-positive character of these organisms, nor does the action of pepsin or trypsin. JOHN T. MYERS

Is sulfuric acid or antiformin preferable in the isolation of the tubercle bacillus? KENTARA HARADA. *Zentr. Bakt. Parasitenk.*, 1 Abt., 113, 266-70(1929). — There is little difference in the 2 methods. JOHN T. MYERS

The biology of the paratyphoid bacillus (behavior in glycerol-fuchsin bouillon, rhamnose solution, and in ammonium chloride-rhamnose solution). FR. HILL. *Zentr. Bakt. Parasitenk.*, 1 Abt., 113, 348-52(1929) JOHN T. MYERS

A new enrichment method for typhoid and paratyphoid bacilli in water and feces. FRIEDRICH HODER. *Zentr. Bakt. Parasitenk.*, 1 Abt., 113, 353-7(1929); cf. C. A. 22, 4144. — A stock soln. of malachite green of 1:250 and of brilliant green 1:200 was used. Mix 38.5 cc. of sterile water, 5 cc. of sterile bile and 5 cc. of bouillon, and add the material to be examd. Add 0.8 cc. of stock malachite and 0.1 cc. of brilliant green, drop by drop. Incubate 3 hrs. and add 0.45 cc. of malachite and 0.15 cc. of brilliant green and continue the incubation. The modification is very satisfactory. JOHN T. MYERS

The influence of the hydrogen-ion concentration and salt content of media on the serological and cultural characteristics of the colon-typhoid, proteus and dysentery groups. LEO OLITZKI. *Zentr. Bakt. Parasitenk.*, 1 Abt., 113, 395-403(1929) — For *B. typhosus* the optimal H-ion conditions for antigenic function development are slightly acid, for *B. proteus*, slightly alk. and for *B. paratyphosus*, neutral. The stable antigen for typhoid and dysentery strains develops somewhat better on a slightly acid, salt-poor medium. JOHN T. MYERS

Observations on species-selective actions. FRIEDRICH BOAS. *Zentr. Bakt. Parasitenk.*, 11 Abt., 78, 21-40(1929) — This is a detailed study of the selective effects of various org. and inorg. mols., anions and cations on various microorganisms. JOHN T. MYERS

Certain acid-tolerant bacteria causing spoilage in canned foods. C. T. TOWNSEND. *Zentr. Bakt. Parasitenk.*, 11 Abt., 78, 161-72(1929) — All the organisms isolated were predominantly saccharolytic, with only slight proteolytic powers. All were very acid-tolerant, and would not be inhibited in any canned food by acidity alone. They are not heat-resistant and spoilage due to non-sporeforming coccoid bacilli seems due to gross under-sterilization. JOHN T. MYERS

Pigment formation as a differential character of microorganisms. N. DMITREVSKY. *Zentr. Bakt. Parasitenk.*, 11 Abt., 78, 352-4(1929) — The amt. and character of the pigment varies with compn. of the medium, O tension and temp. Pigment is especially important in the differentiation of the mesentericus group. JOHN T. MYERS

Cellulose-destroying bacteria. STANISLAUS ŚNIESZKO. *Zentr. Bakt. Parasitenk.*, 11 Abt., 78, 375-80(1929) — Aerobic organisms were isolated which produced clear zones in cellulose media contg. CaCO_3 and buffered with K_2HPO_4 . This supports the contention that such clearing is due to enzyme action rather than to the soln. of CaCO_3 by acids produced during fermentation. JOHN T. MYERS

Questions at issue in iron bacteria investigations. EINAR NAUMANN. *Zentr. Bakt. Parasitenk.*, 11 Abt., 78, 380-4(1929). JOHN T. MYERS

Effect of alcohol upon the lytic principle of d'Herelle. S. RACCHUSA. *Boll. soc. ital. biol. sper.* 4, 549-50(1929). — Added to active bacteriophage, alc. in a concn. of 1:10 causes an attenuation, and finally an apparent destruction of the active principle. Contact for from 24 to 68 hrs. at room temp. causes little if any weakening; exposure for 10 days is more effective but activity becomes evident with the second passage; after contact for 15 days the questionable lysis observed in the first passages cannot be enhanced. G. H. SMITH

Method for testing antiseptic dyes. GEO. F. REDDISH. *J. Am. Pharm. Assoc.* 18, 237-40(1929). — The method was devised by C. L. Himebaugh but unpublished. *Staphylococcus aureus* of normal resistance is grown at 37° in broth and transferred for 3 consecutive days. 0.1 cc. of a $1/100$ diln. of this culture is added to 15 cc. of melted serum-agar (10% blood serum in nutrient agar contg. 1.5% agar), the mixt. cooled to

45°, the culture thoroughly mixed in the serum agar and the mixt. poured into a Petri dish. A glass stopper or vial is placed in the agar until the agar is cooled. The stopper or vial is removed, leaving a cup in the agar. Enough of the antiseptic dye soln. is added almost to fill the cup. If the substance permeates into the agar medium sub-cultures are taken to demonstrate antiseptic action.

L. E. WARREN

Studies on the effect of ultra-violet rays upon the bacteriophage and its physico-chemical nature. KAORU MIZUNO. *Japanese J. Med. Sciences*, VI. *Bacteriology and Parasitology* 1, 52-87(1929).—The bacteriophage is destroyed by ultra-violet rays. The destructive action of ultra-violet rays varies according to the physicochem. status of the medium. It is weak in broth, moderate in H₂O and strongest on agar plates. The bacteriophage is not volatile; its absorption of ultra-violet rays is strong; it is difficult to dialyze; and it may be considered that the bacteriophage is a colloidal substance. Viscosity of broth which contains the bacteriophage is higher than that of normal broth. The bacteriophage lowers the surface tension of the medium. Its dispersion is much weakened by exposure to ultra-violet rays and easily changeable by the addn. of an acid and therefore it must be a sensitive colloid. The bacteriophage is made turbid more rapidly and strongly than the broth by the addn. of an acid, which fact distinguishes the colloidal nature of the bacteriophage from that of the control broth. The bacteriophage is apparently a colloid with a high elec. cond., so that it must be an ionized substance. The bacteriophage is not destroyed by x-rays. From these facts and other mechanisms concerning d'Hérelle's phenomenon the bacteriophage seems to be a fermentative colloidal substance.

H. G. WELLS

Differentiation of hemolytic streptococci of human and of dairy origin by methylene blue tolerance and final acidity. ROY C. AVERY. *J. Exptl. Med.* 50, 463-9(1929).—A grouping of 138 strains of hemolytic streptococci based on differences in dye-sensitivity and in final H-ion concn. of cultures is presented. Three groups are distinguished: human parasitic strains, defined by a final p_H range of 5.2 to 5.0 and by failure to reduce methylene blue (1:5000) in milk; bovine strains parasitic in the udder, characterized by a final p_H of 4.5 to 4.2 and by failure to reduce the dye; saprophytic strains, characterized by a final p_H range of 4.5 to 4.2 and by ability to reduce the dye. Methylene blue was bactericidal for the strains of hemolytic streptococci that fail to reduce it but neither bacteriostatic nor bactericidal for the strains that caused its reduction. C. J. WEST

Bacteria that survive and grow during the pasteurization of milk and their relation to bacterial counts (PRICKETT, BREED) 12.

D—BOTANY

THOMAS G. PHILLIPS

The bases for the stimulation of higher plants. ANNELIESE NIETHAMMER. *Z. Pflanzenernähr. Düngung u. Bodenk.* 14A, 162-9(1929).—A microchem. study of the germinating wheat seeds subjected to the action of a no. of stimulating agents was made by the application of sensitive reagents suitable for testing the presence of the different stimulants in the swelling seed. CuSO₄, MgSO₄, uspulun, uspulun universal, K₂SO₄, KSCN and ZnSO₄ were the stimulants used in appropriate concns. It is shown that with a significant effect of the stimulating agents on the germination and development of wheat seedlings there is not correlated a general entrance of the stimulating agent into the seed. The sterilizing action of a no. of the stimulants is emphasized as a possible explanation of the action. The stimulating action of certain chemicals on fungi and bacteria with semipermeable membranes is cited as true stimulating action. The action of certain stimulants on seeds having semipermeable membranes is considered a positive action while the apparent or passing stimulating action of other stimulants on harder seeds must be considered as indirect.

R. M. BARNETTE

Experiments on the action of dark and light periods on the root nutrition of plants. M. K. DOMONTOVICH AND A. I. GROSHENKOV. *Z. Pflanzenernähr. Düngung u. Bodenk.* 14A, 194-205(1929). Water cultures with oats, corn, sunflowers and cucumbers were carried out in such a manner that the quantity of light was varied as well as the nutrient soln. available to the plant. Conclusions: In periodic N nutrition, the production of dry matter of plants was significantly lower than an unbroken N nutrition. (NH₄)₂SO₄ showed a greater yield of leaves, stems and roots than NaNO₃. Light had a stronger action on development and dry substance production of plants which received NO₃ than those which received NH₄. The absorption of nitrate N was much more significantly increased by light than the absorption of NH₄. The proportion of root development to total development was lower for NH₄ nutrition as compared to NO₃ nutrition. The reduction of the root system cannot be considered as a toxic action of the NH₄ salt.

The roots of plants subjected to periodic contact with solns. of $(\text{NH}_4)_2\text{SO}_4$ showed the property of being able to impart an acid reaction to solns. without $(\text{NH}_4)_2\text{SO}_4$ when removed to such solns. Periodic nutrition with P_2O_5 showed no tendency to reduce the level of dry matter production of the plants. Light had a definite though weak positive influence on the effect of the P_2O_5 nutrition and also on the absorption of P_2O_5 from the solns. Periodic K supply was not sufficiently large to cover the requirements of the plants for K. Light had little if any effect upon the K nutrition. By periodic supply of Ca the plants were almost completely killed. For most of the elements there was a positive light action, i. e., an increase for the effect on the plant. The difference of the action of light on the absorption of the different elements by the plant can be considered relatively speaking as independent of the processes of absorption, the intensity of transpiration, etc.

R M BARNETTE

Physiology of urea in the higher plants. G. KLEIN. *Z. Pflanzenernähr. Düngung* 12A, 390-1(1928).—Urea is present in plants in max. amts. in seedlings, young buds and leaves, and in active tissue. In old leaves and seeds none occurs. Urea in a nutrient medium for plants is partially decomposed outside the plant roots and partially absorbed and decomposed within the plant tissue, and the plant may be poisoned by the NH_3 produced. Urea in young plant tissue is to a large extent combined with aldehydes.

B C. A.

Secondary products in the extraction of glutamine from beets. C. RAVENNA AND R. NUCCORINI. *Boll. inst. agr. Pisa* 4, 149-55(1928).—In the extrn. of glutamine (cf. C. A. 23, 3667), the beet ext. is defecated with Pb acetate, and the ppt. decomposed with H_2S . The filtrate is neutralized with NH_4OH and after crvstn. of glutamine, isoleucine was isolated from the residual soln., as found by Ehrlich in molasses (*Ber* 38, 1809(1905)). It is probable that isoleucine preexists free in the beets. **The disappearance of glutamine and formation of allantoin in beets.** *Ibid* 159-63.—In the beets during the period of utilization of the reserve materials, the glutamine decreases and increases the allantoin; while during the accumulation of the reserve materials there is an opposite phenomenon. Allantoin was found by Smolenski (C. A. 6, 2862) only in the Russian beets. It is suggested that allantoin is formed by metabolism of purine comds. and that its disappearance is due to oxidation processes. **Several compounds derived from ammonium α -hydroxyglutarate.** *Ibid* 167-78. See C. A. 23, 3667. **The significance of the glutamine in castor beans during germination.** R. NUCCORINI (WITH D. TABB). *Ibid* 453-62.—In germinating castor beans glutamine is present in less quantity than glutamic acid in dormant seeds. Glutamine is due to hydrolysis of glutamic acid, and this to decompn. processes of proteins, while asparagine is a synthetic compd. utilized in the regeneration of protein substances.

G A BRAVO

The relation between some constituents of fruit juice and the keeping quality of the fruit at low temperature. G. LEONCINI AND G. LEVI. *Boll. inst. agr. Pisa* 4, 505-15(1928).—Four varieties of peaches were examd., viz. "Victor," "Elberta," "Mayflowers" and "H-Beauty," that keep at 2° without changes, resp. for 42, 39, 38 and 28 days. Analysis of the juice at the beginning of the expts. gave, resp.: moisture 85.92, 86.57, 83.76, 88.32; ash 0.61, 0.52, 0.66, 0.62; sucrose 1.20, 1.11, 1.00, 1.17; *d*-glucose 0.57, 0.49, 0.32, 1.08; fructose 1.77, 1.67, 1.60, 2.14; malic acid 1.737, 1.436, 1.286, 1.396; citric acid 0.070, 0.052, 0.047, 0.041%. During the conservation, the sugars and acids decrease; but in the varieties that keep less well at low temp. sugar decrease is high and acid (chiefly malic acid) decrease is very little.

G A BRAVO

Researches on the fluorescent substances of the plants and on some photolysis phenomena. L. PETRI AND M. DE CRECO. *Boll. staz. patol. veget.* [N. S.] 8, 374-406(1928).—Of exts. of 164 plants examd., 150 contain one or more substances that become fluorescent under the action of ultra-violet rays. These fluorescent substances are glucosides, phloroglucinol tannins or plant pigments. Generally the most dangerous photolytic changes occur in the plants plentifully provided with fluorescent substances. No relation was found between the occurrence of fluorescent substances in the plant and their systematic classification or the sensibility to the light of phototropic plants.

G. A. BRAVO

Effect of the uranium rays and of the ionization of air on the olive tree. LIONELLO PETRI. *Boll. staz. patol. veget.* [N. S.] 9, 93-4(1929).—The normal growth of the olive tree is inhibited by rays from U_3O_8 ; the leaves of treated plants are smaller and provided with star-like hairs on the epidermis. The water absorbed from the treated plants is about 50% of that absorbed from the olive tree under normal conditions. On eliminating the noxious action of rays from U_3O_8 and working only with ionized air, the growth of the olive tree is not improved.

G. A. BRAVO

The tomato stalk and its value as a fodder. P. GUARNIERI. *Chim. ind. agr. biol.*

5, 243-4(1929).—Tomato stalks, after 3 months' storage, contain moisture 73.10, ash 5.68, sol. nitrogenous matter 3.50, fats 1.25, cellulose 11.31, easily digested proteins 2.10%. There is a little (0.008%) solanine in the leaves. No solanine was found in dried stalks.

G. A. BRAVO

The analysis of tomato plants. I. O. OWEN *J. Agr. Sci.* 19, 413-32(1929).—In expts. to det. the role of phosphates in tomato culture, tomato plants were analyzed for K_2O , P_2O_5 and N. In unfertilized plants the fruit is of inferior quality but the wt. as picked is $2.6 \times$ that of the foliage and stems. In fertilized plants this ratio is 1.6. Fertilized plants have a higher ash content than unfertilized. The removal of the 3 nutrients per plant where fertilized is 18.22 g. K_2O , 2.028 g. P_2O_5 and 9.324 g. N; for unfertilized plants the figures are K_2O 2.775, P_2O_5 0.9895 and N 4.922 g. Analyses of trimmings and leaves at different times of the year suggest that the actively growing parts are the richest in the 3 nutrients. The compn. of fresh fruit from fertilized plants is H_2O 93.5, K_2O 0.3237, P_2O_5 0.0491 and N 0.1591%; that for fruit from unfertilized plants is H_2O 94.9, K_2O 0.0556, P_2O_5 0.0355 and N 0.1769%. The distribution of the total nutrients between the fruit and vegetative parts is different for fertilized and unfertilized plants. Tomato plants yielding good crops show a relatively high ash content. Of all trusses on a plant the 3rd and 4th are richest in the 3 nutrients detd. The relative amt. of K_2O in the whole of the aerial parts of the plant tends to fall as the season progresses.

P. R. DAWSON

The formation of xanthophyll, carotin and chlorophyll in illuminated and unilluminated barley seedlings. H. VON EULER AND HARRY HELLSTRÖM. *Z. physiol. Chem.* 183, 177-83(1929).—Barley grains were germinated in the dark for 9 days, then exposed to the light for 5 days, detns. being made daily of the xanthophyll, chlorophyll and carotin content of the seedlings after the 6th day. The xanthophyll content increased regularly from the 6th to the 9th day, but thereafter showed a decrease if the seedlings remained in the dark and a further regular increase when they were brought to the light. During the period of exposure to light the increase in carotin closely paralleled the increase in chlorophyll. Both increased at a more rapid rate than the xanthophyll. In etiolated plants carotin was not found in measurable quantities. Not only chlorophyll formation, but apparently also carotin formation, is a photochem. reaction. These 2 pigments are believed to stand in close relationship to each other.

A. W. DOX

Electrical potential differences in the individual cell. LUDWIG JOST. *Sitzb. Heidelberg Akad. Wiss.* 1927, No. 13, 3-26; *Chem. Zentr.* 1928, I, 2262-3.—The potential differences in the internodal cells of *Chara coronata* and *Valonia* in various electrolytes such as KNO_3 - $LiNO_3$ or KCN - K_2SO_4 were detd.

C. R. FELLERS

Factors influencing the growth and sugar content of cane. K. KRISHNAMURTHI RAO. *J. India* 24, 91-101(1929).—A review with special reference to conditions in India.

K. D. JACOB

The effect of mineral water on higher plants. G. BILLARD AND A. MOUGROT. *Presse méd.* 37, 546-51(1929).—The action of different French mineral waters on the germination and first development of 3 classes of seeds has been studied. The favoring or retarding action varies with the pH of the water, its compn. and the group of seed, according to the nature of the reserve substance, whether fat, protein or starch. The action is exerted on the cells directly. The sprouting of leaves of *Vitis vinifera* was generally retarded. Two exceptions are attributed to the chem. compn. of the water. The root depends more on the pH with an optimum at 6.5. The optimum for the root of *Salix viminalis* is pH 7.6. The blossom also depends on the pH . The stem of the tulip regulates the pH to 6.5-6.7 and preserves the blossom.

A. E. MEYER

The effect of certain salts on the germination of seeds of *Amarantus retroflexus* L. B. N. AXENTYEV. *Biochem. Z.* 211, 454-67(1929).—The percent of germinating seeds in various salt solns and mixts. was detd.

S. MORGULIS

Studies on the processes in tobacco fermentation. THALES ANDREADIS. *Biochem. Z.* 211, 378-94(1929).—The cleavage of methoxyl is brought about by pectase found in tobacco leaves. This hydrolyzes pectin so rapidly that it is even amazing that any MeOH ester remains in the leaves. Through autolysis also MeOH is set free from pectin, to the extent of about 50% in 2 hrs., or even through the action of H_2O at high temp. whereby the H -ion concn plays an important part. Hexosediphosphatase, lipase, amylase and ketone aldehyde mutase were also demonstrated in the ripe tobacco leaf.

S. MORGULIS

Electrical effects accompanying the decomposition of organic compounds, considered in relation to photosynthesis and plant nutrition. M. C. POTTER. *Zentr. Bakt. Parasitenk.* II Abt., 78, 56-63(1929).—Since the breaking down of carbohydrates sets free electromotive force, part of the energy stored in the plant must be electrical.

Catalysis (as in respiration) and synthesis (as in photosynthesis) are always accompanied by an e. m. f., the signs being opposite in the two operations. The origin of all e. m. f. in living plants is the physico-physiol reactions taking part in the life processes of the various cells. The e. m. f. is an index of the plant. The gases liberated in catalysis and in physiol. and atmospheric combustion are org. and are ionized (activated). Elec. energy liberated by the ionized gases appears to be an essential factor in photosynthesis. Thus the amt. of ionized CO_2 , not of inactive CO_2 , is important. The decrease of atm. potential about trees in foliage is in accord with this. Catalytic enzymes which render energy kinetic must differ from synthetic enzymes which render energy potential. There must be endo-electric and exo-electric reactions analogous to endo- and exo-thermic reactions and a relation must exist between the two forms of energy. E. m. f. is liberated by all decompn. of org. matter in soil and water, and there is some evidence that the plant uses this energy in growth.

JOHN T. MYERS

The biology of yeasts in aerated culture media. FRIEDRICH WELEMSKY AND EGON BUTSCHOWITZ. *Zentr. Bakt. Parasitenk.*, II Abt., 78, 178-91(1929).—The marked increase in multiplication of yeasts when air is drawn through the culture is not due to increased O tension but to agitation, which decreases local concn. of metabolic products. The formation of alc. seems to be a normal yeast cell function which does not interfere with cell division.

JOHN T. MYERS

Studies on the yeasts of nectar. HEINRICH ZINKERNAGEL. *Zentr. Bakt. Parasitenk.*, II Abt., 78, 191-222(1929).—The only sugars in the nectar of most plants were dextrose and levulose. In one case saccharose was found. The yeasts found wild in nectar usually fermented only these 2 hexoses

JOHN T. MYERS

The influence of the electric current of low and high frequency on the growth of various microorganisms. HELMUT DRITZ. *Zentr. Bakt. Parasitenk.*, II Abt., 78, 386-403(1929).—A 220-v. current with a 50-period cycle, and Ag electrodes was definitely bactericidal, probably in consequence of the electrolytic formation of injurious substances in the medium. Ag ions play a part, since bactericidal action decreases when they are pptd. However, the Ag ions mitigate the effect of Cl. Yeast cells in large no. decrease the effect by adsorbing toxic radicals. The current from Ag electrodes was just as injurious as from Pt because Ag ions destroy amino compds. and thus interfere with the source of N for metabolism. A magnetic field induced by a high-frequency current (3 million) increased the rate of growth of organisms in both liquid and solid media. This is probably due to thermal and purely elec. effects in the yeast cell rather than to secondary chem. action. The same high-frequency current passed through a culture had little effect because there were few electrolytic changes.

J. T. M.

Some chemical and morphological phenomena attending infection of the wheat plant by *Ophiobolus graminis*. HURLEY FELLOWS. *J. Agr. Research* 37, 647-61(1928).—Microchem. studies made on the roots of wheat plants infected with the disease known as take-all showed that the disease caused a non-uniform reduction of cellulose which was replaced by lignin and a slight amt. of suberin. This is especially true of the thickened cell walls and the lignitubers. Other substances are not changed by the disease.

W. H. ROSS

The translocation of potassium in tomato plants and its relation to their carbohydrate and nitrogen distribution. GEORGE JANSSEN AND R. P. BARTHOLOMEW. *J. Agr. Research* 38, 447-65(1929).—A study was made of the tomato plant in relation to its carbohydrate, N and K_2O assimilation. The plants used were grown on a full K nutrient soln. until 6 in. high and then transplanted with the exception of the check plants to a sand culture contg. no K. Microchem. analyses made at various stages in the growth of the plants show an increase in the percentage of dry matter in all parts of the low-K plants. The total dry wts. of high-K plants increase rapidly after the bloom stage. An inverse relationship exists between the K and the N content of the plant when the K is insufficient for normal growth, the total and water-sol. N being much higher for the low-K plants. In K-starved plants the K seems to be transferred to and localized in the meristematic and growing portions of the plants. Leaf starvation of the tomato due to the lack of K is progressive, extending from the lower to the upper leaves. The dead leaves are relatively free from K indicating that K had been translocated and reutilized by the growing portions of the plant.

W. H. ROSS

Relation of leaf acidity to vigor of wheat grown at different temperatures. ANNIE M. HURD-KARRER. *J. Agr. Research* 39, 341-50(1929).—The concn. of H ions in leaf juice of Hard Federation, Harvest Queen and Turkey wheats grown at temps. of 12-18°, 20-25° and 25-30°, resp., was found to be lowest at the low temp. and highest at the high temp. The first-mentioned variety grew vigorously and yielded well at both the low and medium temps., but the other 2 varieties grew normally at the low temp. only.

The medium-temp. plants of all 3 varieties grew most rapidly at first and almost without exception had the lowest titratable acidity, sp. gr., and dry wt. percentages throughout their vegetative stages. The high-temp. plants generally had the highest titratable acidity, sp. gr. and dry-wt. percentages. The magnitudes of the titratable-acid values were closely correlated with those of the sp. gr. measurements at all 3 temps. The p_H value reflected the degree of adaptability of each variety to the different temps. Those plants which were best adapted, as shown by a vigorous growth and development, had p_H values near 6.0 throughout the expt. Plants which were so injured that they failed to develop beyond the shooting stage developed much higher H-ion concns., extreme injury being accompanied by values near 5.6, while the plants were still in the vegetative stage.

W. H. ROSS

The mean and variability as affected by continuous selection for composition in corn. FLOYD L. WINTER. *J. Agr. Research* 39, 451-76(1929).—Continuous selection for protein and oil content in corn over a period of 28 yrs. has produced 4 types which are distinctly different in their compn. When compared with the original nonselected material the high-protein and the high-oil strains show a proportional increase of 50.01 and 109.79%, and the low-protein and low-oil strains a proportional decrease of 23.26 and 67.87%, resp. The high-protein and high-oil strains show no indications of having reached a limit to further increases. The low-protein strain has changed but little during the last 20 yrs, and the low-oil strain is approaching a physiol. limit to further decreases.

W. H. ROSS

A study of the nature of the nitrogenous compounds in fungous tissue and their decomposition in the soil. A. FLOYD HECK. *Soil Science* 27, 1-47(1929).—The C content of all fungous tissue studied is rather const., fluctuating for the most part only between 40 and 44%. The N content of the fungi found growing in the fields and woods varies from 1.5 to over 7%, and the most of these forms contain more than 4% of N on a dry basis. In mycelium produced on synthetic liquid media, the N varied from less than 2% to more than 6% for the same species. Fungous N is for the most part very simple. From 40 to 70% of the N in the dry fungous tissue used in this work was H_2O -sol. and of this portion, 80 to 92% was dialyzable through a collodion sack. From 80 to 85% of the total N was sol. in 0.05 N NaOH in 60% alc. From 40 to 65% of the N in the H_2O sol. and alc.-sol. fraction was free amino N. No urea was found in the tissue tested. Most fungous tissues decomp. readily in moist soils. From 40 to 60% of their C is liberated as CO_2 in 26 days. On decompn. the N which they contain is liberated as NO_3 to the extent of from 30 to 42% of the original amt. during a period of 26 days. When there is no other energy material present, living fungous tissue liberates its own N by autolysis to even a greater extent than the dead tissue. The N in fungous tissue in the soil is as readily nitrified as, or even more rapidly nitrified than, that of other org. materials of similar N content.

E. F. SNYDER

Amylases of the cereal grains —oats. JULIAN L. BAKER AND HENRY F. E. HULTON. *J. Chem. Soc.* 1929, 1655-60.—Amylase pptd. from alc. from ungerminated oats acts differently from that of rye and barley. It liquefies starch paste slowly, the diastatic power being only 2°. It produces only cryst. maltose from potato starch at 50°, indicating that the starch mol. consist of condensed maltose residues. It has a solvent action on oat starch, producing glucose. The amylase from germinated oats liquefies starch paste readily, producing a dextrin, a malto-dextrin-like substance and a sugar having the const. of maltose.

AMY LE VESCONTE

Celluloses of some Australian plants (ARNEMAN, EARL) 23. The chemistry of pectins from fruit (DHRICH, KOSMAHY) 10.

E—NUTRITION

PHILIP B. HAWK

Methods of detecting vitamins, particularly vitamins A and B. E. C. VAN LEERSUM. *Nederland. Tijdschr. Geneeskunde* 73, II, 3997-4009(1929).—A review dealing particularly with the biological methods of tracing vitamins; increase of weight is no reliable indication for vitamins; changes of bony structures are to be preferred for detn. R. B.

A widespread occurrence of xanthine calculi in sheep. T. H. EASTERFIELD, T. RIGG, H. O. ASKEW AND J. A. BRUCE. *J. Agr. Sci.* 19, 573-84(1929).—The occurrence of xanthine calculi in the kidneys of sheep on certain poor pastures in the Monterey Hills, Nelson District of New Zealand, appears to be assoc. with soils highly deficient in both Ca and P_2O_5 . The analysis of pasture samples shows a striking deficiency of both these constituents. Samples of green growth, obtained after a dry summer and fall, show a great deficiency of Fe and an abnormally high content of Mn. In spring

samples the content of these elements is normal. It is suggested that Fe deficiency is not the main factor contributing to the disease. Typical "Bush" sickness, definitely assocd. with Fe deficiency, is not known in this region. P. R. DAWSON

Some analytical remarks on the vitamin A. S. H. BERTRAM. *Proc. Acad. Sci. Amsterdam* 32, 664-8(1929).—B. discusses some of the literature in the light of his own results. The original should be consulted. J. A. KENNEDY

Nature of the rickets-producing factor in cereals. L. MIRVISH. *Nature* 124, 410-11(1929).—It has been suggested that the production of rickets by an excess of cereal may be due to an antivitamin. To det. this, oatmeal was boiled with 1% HCl and dialyzed. The dialyzate was evapd. to dryness and extd. with 95% alc., which was again evapd. When this residue, dissolved in water, was injected into rabbits, it lowered the blood Ca 30-35% in 24 hrs. with a return to normal in 48 hrs. This action is similar to that of an ext. of bovine ovaries made the same way. Rickets is primarily due to the lowering of blood Ca, which in turn may be caused by lack of Vitamin D, by excess of cereals, or by a faulty Ca-P ratio. AMY LEVESCONTE

Vitamin B. RUDOLPH A. PETERS. *Nature* 124, 411(1929).—At least 5 vitamin B factors have been described. They are: (1) the original thermolabile antineuritic factor, (2) a thermolabile factor described by V. Reader (*J. Soc. Chem. Ind.* 47, 1247 (1928)), (3) the thermostable antipellagra factor, (4) a thermostable factor described by Hunt (*C. A.* 23, 417) and (5) the factor described by Williams and Waterman (*C. A.* 22, 3907). AMY LEVESCONTE

Vitamins. ALFRED CLARK. *Trop. Agr. (Trinidad)* 6, 81-2, 110-11, 138-40, 166-9(1929).—A summary of the present state of knowledge regarding the nature of vitamins and the consequences of consuming diets lacking them. A. L. MEHRING

Animal nutrition. T. B. WOOD. *Trop. Agr. (Trinidad)* 6, 198-9(1929).—An equation was derived by which the maintenance requirements of animals and the starch equiv. of feeds may be calcd. as follows: $R = Kw^2/m + gc$, where R is the ration in starch equivalents, K is a const. (nearly 0.053 for all farm animals), w is the live wt. in lb., m is the basal metabolism per unit area per unit time, g is the live wt. increase in lb. per day and c is the wt. of starch equiv. required to make 1 lb. of live wt. increase. When 100 sheep were fed a ration calcd. to produce a live wt. increase of 2.25 lb. per week according to the equation, an actual increase of 2.22 lb. was obtained. A. L. MEHRING

Irradiated ergosterol in rickets. A. B. MARFAN. *Presse méd.* 37, 749-52(1929). A. E. MEYER

Vitamin D and craniotabes; the necessity for a biological control of commercial vitamin preparations. J. P. GARRAHAN AND J. C. TRAVERSARO. *Semana méd* (Buenos Aires) 36, 824-7(1929).—Sixteen cases of craniotabes were treated with commercial vitamin D preps.; 4 became worse, 9 were unchanged and 3 improved. A. E. MEYER

The vitamin B content of different yeasts and of wheat bread prepared therewith. ARTHUR SCHUBNERT AND MARTIN SCHIEBLICH. *Biochem. Z.* 212, 80 6(1929); cf. *C. A.* 23, 1165.—Bakers' yeast contains only $1/2$ to $1/3$ of the antineuritic factor of vitamin B as brewers' yeast, but in regard to the antipellagra and growth-promoting factor there is no difference between them. With baked bread contg. the usual amt. of yeast it is impossible to give pigeons the necessary protection because they cannot consume enough of the food, but such is the case with bread contg. 3 times the ordinary quantity of yeast. In rat expts. it was possible to demonstrate that bread prepd. with baking powder is inferior to that made with yeast. S. MORGULIS

The Metchnikoff theory and the influence of diet on the intestinal flora, growth, abortion, fecundity and blood picture in the white rat. V. Growth, abortion and fecundity on a variety of diets and the accompanying intestinal flora. MARTIN SCHIEBLICH. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 41-55(1929). VI. The blood picture in a variety of diets, and the accompanying intestinal flora. *Ibid* 55-63; cf. *C. A.* 23, 4727. JOHN T. MYERS

Role of vitamin C in the nutrition of calves. L. M. THURSTON, L. S. PALMER AND C. H. ECKLES. *J. Dairy Sci.* 12, 394-404(1929).—Vitamin C was found in the livers of calves fed for one year on food which produced scurvy in guinea pigs in 30 days. Heifers, fed from birth on a diet deficient in vitamin C, gave normal reproduction and secreted vitamin C in the milk. Vitamin C is probably synthesized in the bovine body, though tests indicate the absence of vitamin C in the stomach and feces of the calf. N. M. NAYLOR

Vitamins. A short review of later investigations. CARL H. HANSEN. *Dansk. Tids. Farm.* 3, 125-30(1929).—The properties of vitamins A, B and C are briefly discussed. Of these the fat-sol. vitamin A is considered at some length. This vitamin was

formerly found to be antixerophthalmic, antirachitic and capable of accelerating growth. Lately it has been shown that it may be divided, and a vitamin D which is antirachitic obtained. The vitamins A and D were found only in animal fats, but lately by exposure to light with a wave length of about 300μ inert plant oils, *e. g.*, olive oil and linseed oil, could be made antirachitic. The possible sources of vitamins are also considered.

O. A. NELSON

The nutritive requirements of milch cows in relation to the composition of the milk produced. NILS HANSSON. *Proc. 8th World's Dairy Congress 1928*, 190-7.—Tests carried out over a period of 2 decades have shown that: (1) The quantity of productive food required by milch cows, both with regard to the general food value of the food and to its albumin content, is to a high degree dependent on the compn. of the milk produced. (2) The albuminous substances contained in the food may be limited to the quantities which fulfil the special function of these food substances, since the fat and sugar in the milk are mainly formed from non-nitrogenous food substances, particularly carbohydrates. (3) Milch cows can transfer into the milk a much larger proportion of the digestible energy in the food than fattening cattle; on an av. one can calc. that the latter can only absorb about 80% (78-82) of the net energy which the milk produced contains. (4) The nutritive requirements of milch cows is directly dependent on the energy content and the albumin content of the milk produced. (5) The production food required by milch cows may be estd. as 0.30 food unit (defined as the amt. of net energy, which, with an all-round diet, is recovered in the amt. of milk produced by 1 kg. of barley or by the quantities of other foodstuffs equiv. thereto) per kg. of milk when the fat content of the latter amounts to 2.75% and to 0.42 food unit when the fat content is 5.0%. (6) Under normal conditions a max. of 75% of the digestible albumin contained in the food is to be found in the milk; this figure, however, is dependent on the biol. value of the albumin in the food, and it is, therefore, advisable to continue to reckon with at least 45-50 g. of digestive albumin per kg. of milk. (7) Feeding quantities of albumin amounting to not more than 10-20% above the min. thus calcd. to some extent stimulates the yield of milk, but a further increase in the amt. of albumin does not seem to have any further effect. A bibliography of 15 references is given.

A. PAPINEAU-COUTURE

Activated milk. HOFFMAN. *Proc. 8th World's Dairy Congress 1928*, 460-2.—The 2 main difficulties in activating milk by treatment with ultra-violet rays are that the rays must act upon a very thin layer of milk and that change of flavor (jecorization) must be avoided. H. has devised an app. for overcoming these, the milk flowing through an adjustable slotted distributor over a narrow-mesh corrugated wire cylindrical net in the center of which is the irradiating app. To avoid jecorization the source of light is a sort of quartz Geissler tube with condenser electrodes filled with Hg-A which emits cold rays instead of the usual quartz lamps which emit intense heat rays. An air lock or the use of a protective gas is unnecessary. Destruction of vitamins A and C by O_3 which may be formed when air is permitted to enter the app. is of no consequence in the case of pasteurized milk, as these vitamins are already destroyed by pasteurization; with raw milk, a protective gas (preferably N) can be used. Rats fed on rickets-producing food with an addn. of 8 cc. of ray-treated milk showed after 3 weeks of such feeding no signs of rickets, as compared with the control animals. Animals suffering from rickets became quite healthy after being fed 4 weeks with ray-treated milk (6 cc. per day), while the animals fed on untreated milk either died or did not recover.

A. P.-C.

Antineuritic and water-soluble B vitamins in beef and pork. RALPH HOAGLAND. *J. Agr. Research* 38, 431-46 (1929).—Lean pork is an excellent source of the antineuritic vitamin, comparing favorably in this respect with brewers' yeast. Beef contains much less of the antineuritic vitamin than pork. Lean pork is also a good source of water-sol. B vitamin but it does not contain so much of these vitamins as either brewers' or bakers' yeast. No material difference was observed between fresh and smoked hams as sources of either the antineuritic or water-sol. B vitamins. Lean beef contains much less water-sol. B vitamins than lean pork.

W. H. ROSS

Influence of desiccated thyroid and iodine on growth. II. With a standard acid diet. F. E. CHIDESTER AND W. M. INSKO, JR. *Am. Naturalist* 43, 239-47 (1929).—Exptl. data are given.

G. SCHWOCH

Minimum protein requirements of cattle. H. H. MITCHELL. *Bull. Natl. Research Council* No. 67, 84 pp. (1929).—A bibliography and a review of the literature are given. Sherman's value of 0.6 g. of N per kg. of body wt. as the minimum protein requirement for maintenance of N equil. and the values of others, ranging from 0.4 to 0.7 g., seem to be too high, even if allowance is made for a large margin of safety. Low values of 0.2 g. of N have been published along with evidence that shows that the animal adjusts itself to a low N intake. A value of 0.3 g. per kg., or 0.19 lb. of protein per 1000 lb. of body

wt., is a safe min. for pigs, sheep, cattle and men. The protein requirement for growth is measured by the rate of deposition of protein in the tissues of growing animals and must be differentiated from the protein requirement of fattening. The only reliable evidence from which the N requirement of growing cattle can be estd is that of the Mass. Agr. Expt. Sta. N retention is from $1/3$ to $1/2$ that predicted from the Armsby equation. It seems improbable that there is any such generalized relation between gain in protein and age of the animal, as assumed by Armsby. The equiv. age of Brody rather than the absolute age of A. may prove more useful in calcg. rate of growth. The protein requirements for fattening, pregnancy and milk production are discussed. The problems of nutrient requirement of animals will be solved satisfactorily only when it is factored into its ultimate and independent terms of size, stage of gestation or rate of milk production.

H. GREGG SMITH

Hyperavitaminosis. I. Studies on the metabolism of the hyperavitaminized rabbit. H. SUGATA. *Sei-i Kwai Med. J.* 48, No. 4, 1-44 (1929), Abstract Sect. No. 4, 1-9.—When an excess of vitamin A is injected into the rabbit, there is a gradual increase in blood non-protein N, uric acid, creatinine and creatine and a decrease in urea. Blood sugar shows a temporary rise followed by a drop in amount. Glycogen of the liver and muscles decreases. Plasma lecithin and fatty acids increase more than does cholesterol, while in controls, injected with cholesterol and olive oil or with cod-liver oil, cholesterol instead of lecithin tends to increase. The animals show almost the same symptoms as when emaciated after vigorous exercise and they die in a short time. With moderate doses of the vitamin there is a subcutaneous accumulation of fat and a decrease in urinary excretion, the two factors together causing an increase in body wt. There is a negative nitrogen balance and a decrease in urea and increase in ammonia excretion. These results furnish evidence that death caused by excess vitamin A is the result of destruction of cell activity, due to overfunction.

H. GREGG SMITH

The metabolism of the hypervitaminized rabbit. H. SUGATA. *Sei-i Kwai Med. J.* 48, No. 6, 1-37, Abstract Sect. No. 6, 1, cf preceding abstract. The death of hypervitaminized rabbits is due to the destruction of cell activity.

E. J. C.

Irradiation of sterols; relations between irradiated sterols and antirachitic vitamin. R. FABRE AND H. SIMONNET. *J. pharm. chim.* [8], 8, 489-506 (1928), cf *C. A.* 22, 3438; 23, 421, 2741.—The studies on irradiation of cholesterol and ergosterol since 1925 are reviewed. The spectroscopic method for the examn of sterols before and after irradiation is discussed in detail, and ultra-violet absorption curves of ergosterol in alc. soln. (1:10,000) before and after irradiation for 10, 20 and 30 min. are shown. Irradiations alter the mol. of ergosterol, producing a trace of a compd. photochemically unstable but having very pronounced antirachitic properties. A list of 36 references is given.

S. WALDBOTT

Activity of irradiated ergosterol. RENÉ FABRE AND H. SIMONNET. *J. pharm. chim.* [8], 9, 331-8 (1929); cf *C. A.* 22, 3438 and preceding abstr. Very active products were obtained whether ergosterol (A) was irradiated (a) dry for 30 min. or 6 hrs., or in Et_2O soln. for 20-30 min., cold, in an inert atm., or (b) for 6 hrs., with no precautions, in alc. soln., but no simple relation appeared between the antirachitic property and the no. and position of maxima of the ultra-violet absorption curve, or the behavior toward digitonin (B). In a the character of the curves remained unchanged and the ppt. with B was but slightly lessened; in b the product, a yellowish resin, gave but feeble pptn. with B, and the character of the curve was thoroughly changed (diagrams are given). By fractional pptn. of irradiated a in Et_2O soln. with weak alc., 2 cryst. ppts. were obtained devoid of activity but they gave nearly the same curves as the original; the residual amorphous A had the full antirachitic property, and the curve was identical with that in b. Hence the significance of phys. and chem. tests can be established only by comparison with biol. examn.

S. WALDBOTT

Sodium and potassium balances when used as citrates in acidotic and rachitic conditions in rats. JOHN H. SPEER, VERA V. COLE AND FREDERICK W. HEYL. *J. Am. Pharm. Assoc.* 18, 225-8 (1929); cf *C. A.* 23, 4592.—Rats were kept on diets sufficiently deficient to produce acidosis. One lot of rats was fed Na citrate and the other half a mixt. of Na and K citrates, the total alky. being the same for each lot. Ca lactate was added to each. Na and Ca do not conserve K; Na and Ca favor Ca retention. Na, K and Ca favor K retention and also Ca although too much K with low Na is less favorable to retention of Ca. No difference was found on P retention whether Ca, K and Na were added or only Ca and Na. Most favorable results were obtained with all three elements Ca, Na and K added. The proportions of Na to K should be about as 5.9:1.

L. E. WARREN

Limitations of the antimony trichloride test for quantitative estimations of vitamin

A. W. S. JONES, A. E. BRIDG, S. ARZOOMANIAN AND W. G. CHRISTIANSEN. *J. Am. Pharm. Assoc.* **18**, 253-6(1929).—The SbCl_3 test for vitamin A developed by Wokes and associates (*C. A.* **21**, 3918) was compared with the biol. test on a no. of specimens of cod-liver oil. In general, the results from these two types of tests were so incomparable that slight dependence can be placed on the color test for quant. evaluation. L. E. W.

A literature review on the production of anthracitic substances by irradiation. ELIZABETH PICKERING. *J. Am. Pharm. Assoc.* **18**, 359-71(1929). L. E. WARREN

F—PHYSIOLOGY

E. K. MARSHALL, JR.

Oxygen absorption curve of fatigued muscle as a function of hydrogen-ion concentration. M. COMELI. *Atti accad. Lincei* [6], **8**, 255-7(1928); cf. *C. A.* **22**, 3894.—The curve of O absorption by fatigued frog's muscle in solns. of varying p_{H} values shows 2 points of inflection and a max. By writing $y = f(p_{\text{H}})$, where y is the rate of absorption of O, it is found that $y = 0$ when $p_{\text{H}} = 5.3$. The complete curve may be represented by $y = ax + bx^2 + cx^3 + dx^4$, where $x = (p_{\text{H}} - 5.3)$. The coeffs a and c are pos., and b and d are neg. On analysis, the curve may be regarded as consisting of 3 portions divided by the points of inflection which occur at p_{H} 7.0 and 6.6, resp. The first portion, for p_{H} values near neutrality, corresponds with a high rate of O absorption. Between p_{H} 6.6 and 6.0 recovery of the muscle is moderately rapid and may be taken to represent physiol. conditions. At p_{H} values below 6.0 the absorption rate falls rapidly, becoming zero at p_{H} 5.3. B. C. A.

Recent investigations on the humoral regulation of the heart. DEMOOR. *Bull. acad. roy. med. Belg.* [5], **8**, 882-902(1928).—A review and discussion of the work of Zwaardemaker (*Ergeb. Physiologie* **19**, 5, 326) and Haberlandt (*Das Hormon der Herzbewegung*, Berlin, 1927). D. objects to describing the active substances of the heart as hormones. R. BEUTNER

A chemical study of urine as affected by combinations of ammonium chloride and methenamine. EDWIN C. WISE AND FREDERICK C. WISE. *Arch. Internal Med.* **44**, 252-62(1929). Ingestion of 15 grains NH_4Cl in human adults on a diet producing nearly neutral urine rapidly lowers the p_{H} of urine to 5.5. The effect of combining this salt with methenamine on the concn. of CH_2O in the urine is described. J. B. BROWN

Thyroid and growth. FREDERICK S. HAMMETT. *Quart. J. Biol.* **4**, 353-372 (1929).—Mostly a review. J. B. BROWN

The differentiation of the reducing bodies in the urine during pregnancy. REED ROCKWOOD AND EVA F. DODGE. *Surgery Gynecol. and Obstet.* **47**, 660-4(1928).—Twenty eight % of a series of urines from pregnant women showed reduction by the Benedict test. In 5 cases osazones of unknown type were isolated. It was possible to isolate lactosazones in only half of the non-fermentable specimens. Before breast engorgement the reducing body is usually glucose while during that stage it is usually lactose. J. B. BROWN

A study of the metabolism of two breeds of pig. (With some remarks on a third.) THOMAS DEIGHTON. *J. Agr. Sci.* **19**, 140-81(1929). Calorimetric studies were made of the metabolism of a Berkshire and a Middle White pig. Conclusion: The existence of a max. somewhere in the curve showing fasting catabolism per unit area at different ages is necessitated by the 2 phys. facts: (a) that warm-blooded animals have to be maintained at a temp. which varies only within very narrow limits and (b) that the processes of growth are accompanied by waste of energy as heat. The fasting catabolism per unit area in pigs is shown to be greater than that in several other animals, including man. A bibliography of 38 references is appended. P. R. DAWSON

Furthering of bone growth by injection of bone extract. CARLA ZAWISCH-OSSENITZ. *Wiener klin. Wochschr.* **42**, 733-7(1929).—An enzyme prepn. from areas of rapid bone development in young animals injected subcutaneously favors bone growth. D. B. DILL

The question of choline in the placenta and its relation to labor pains. FRITZ WREDE, ERICH STRACK AND ELSE BORNHOFFER. *Z. physiol. Chem.* **183**, 123-32(1929).—According to Sievers (*C. A.* **22**, 3919) the human placenta contains many times as much choline as do other organs; hence there is in the placenta a mobilization of choline which brings about the contractions by which the fetus is expelled. Sievers reported a choline content corresponding to 90 mg. per kg. of fresh placenta. He compared this with the choline content in mg. per organ of beef suprarenals and ovaries reported by other investigators. Such a comparison is obviously absurd. Detns. now reported by the

authors run considerably higher, viz., 185 mg. per kg. of fresh placenta. A comparison of the choline content of cow placenta (114 mg. per kg.) with that of other organs, *e. g.*, spleen, pancreas, lung, muscle, kidney and intestine (150-300 mg. per kg.) disposes of the mobilization theory. Moreover, placentas obtained by Caesarian section in cases where the contractile power was insufficient to expel the fetus showed the same choline content as placentas from normal births. Sievers' view that the pressure on the placenta at the time of birth forces choline into the uterus and thus promotes the uterine contractions is untenable in the light of these observations. A. W. DOX

The influence of muscle training on the content of phosphorus compounds. D. FERDMANN AND O. FEINSCHMIDT. *Z. physiol. Chem.* 183, 261-8(1929).—The "training" consisted in stimulation of one biceps femoris of a rabbit 3-4 min. at 4-hr intervals by means of an induction current, the other biceps serving as a control. After 9-22 days of this treatment the animals were killed and the muscles analyzed. The training resulted in a high increase in the creatinephosphoric acid content of the muscle. Unlike the increase in glycogen content obtained in this way by other investigators, the increase in creatinephosphoric acid is not permanent and disappears within 4-6 days after the training is discontinued. No change was observed in the pyrophosphoric acid content of the muscle. The hexosephosphoric acid content showed no increase, but on the contrary a slight decrease. This substance evidently is not a source of energy for muscular contraction, and represents merely an intermediary product of carbohydrate metabolism. A. W. DOX

Secretion of digestive enzymes in relation to blood chemistry. I. Alkali reserve and chlorides in blood. S. I. PRIKLADOVITZKII AND M. P. BRESTKIN. *Z. ges. expl. Med.* 64, 494-505(1929).—See *C. A.* 23, 4246. F. L. DUNN

The chemistry of hormones. O. MÜHLBOCK. *Metallbörse* 19, 1575-6, 1685-6(1929).—A general account of hormones, including adrenaline, insulin, thyroxine, etc. W. C. EBAUGH

Reciprocal relations between ovarian function and the mineral content of the blood. A. SCHEPETINSKY AND M. KAFITIN. *Arch. Gynakol.* 136, 397-406(1929).—A study was made of the mineral content of the blood in 60 healthy women aged from 19 to 30, the detns. being made on the same individual in various phases of menstruation. The Ca content varied within normal limits during menstruation and increased slightly toward the upper limit of normal in the premenstrual period. The K content tended to decrease during menstruation while the Na content decreased markedly and the chloride content was relatively low. The content of inorg. P remained within normal limits in the premenstrual period and during menstruation. In primary and secondary amenorrhea (hypofunction of the ovary) the Ca content remained in the upper limits of normal; the P, Na and chloride contents were normal and the K content was considerably decreased. In the climacteric the K, inorg. P and Na contents remained normal; the Ca content varied with the individual, sometimes increasing and sometimes remaining within the normal limits; while the chloride content decreased. HARRIET F. HOLMES

A comparative study of the digestion of proteins and carbohydrates in goats during infusoria-free and infected periods. ELERY R. BECKER, J. A. SCHULZ AND M. A. EMMERSON. *Proc. Nat. Acad. Sci.* 15, 691-3(1929).—Digestion tests were made on 4 goats rendered free of rumen infusoria for 2 or 3 weeks and then reinfected with *Entodinium* and *Diplodinium*. In both cases the same wt. of hay and grain mixture was fed. Detns. were made of the digestibility coeffs. of the protein, ether ext., N-free ext., crude fiber, hemicellulose, pentosans, α -cellulose and total dry matter, the partition of N between feces and urine, and the N stored daily. None of these showed any significant advantage to the host from the possession of infusoria. AMY LE VESCONTE

Some chemical investigations of embryonic metabolism. IV. An investigation of the basic amino acids of the hen egg during development. H. O. CALVERY. *J. Biol. Chem.* 83, 649-56(1929); cf. *C. A.* 23, 4725.—The basic amino acid content of the developing hen egg has been detd. throughout the entire period of development. The arginine remains practically const. during the entire period. The values for histidine and lysine were both inconsistent but it is believed that both of these amino acids decrease in amt. The results are entirely in agreement with the theory that arginine does not serve as a precursor of purines while histidine may do so. A. P. L.

Composition of bone. VII. Equilibrium of serum solutions with dicalcium phosphate. M. J. SHEAR, MARTHA WASHBURN AND BENJAMIN KRAMER. *J. Biol. Chem.* 83, 697-720(1929).—See *C. A.* 23, 2451. **VIII. Conductivity titrations of calcium ion with chloride, acetate, lactate and citrate ions at 38°.** M. J. SHEAR, BENJAMIN KRAMER AND LOUIS RESNIKOFF. *Ibid.* 721-35.—NaCl, AcONa and Na lactate give normal cond.

titration curves with CaCl_2 at 38° . Na citrate gives abnormal curves but the same type of curve is obtained regardless of whether the Ca soln. is acid, neutral or alk. in reaction. These results are further evidence for the binding of Ca ions by citrate ions in some kind of sol. slightly ionized complex.

A. P. LOTHROP

The occurrence of a new highly unsaturated fatty acid in the lipides of the brain. J. B. BROWN. *J. Biol. Chem.* 83, 783-90(1929).—A highly unsatd. acid of higher mol. wt. and more unsatd. than arachidonic acid has been isolated from the brain. It has a b. p. above 250° and it is suggested that the acid may be a penta-unsatd. lignoceric acid, the name of which would be tetracosapentenoic acid. Arachidonic acid is also present and besides these 2 there may be in addn. other unsatd. acids from the C_{20} to the C_{24} series. Different preps. from the brain give a content of 11.5 to 18.4% of highly unsatd. acids, which is much higher than that for any other tissue studied. Only 24% of the total wt. of the lipides can be recovered as the Me esters and about 10% is cholesterol. A considerable amt. of high-boiling material cannot be distd. even in a high vacuum.

A. P. LOTHROP

The thermal zone of neutrality in the basal metabolism of the albino rat. BRANIMIRO MALES AND JAIME MAGAZ. *Boll. soc. ital. biol. sper.* 4, 461-5(1929). P. M.

A sulfuric acid ester of protein in the anterior lobe of the hypophysis. SIGMUND FRÄNKEL AND GABRIELE MONASTERIO. *Biochem. Z.* 211, 259-63(1929).—The anterior lobe ground aseptically in physiol. saline loses both its ovarian and its growth effect on heating or on addn. of too much alc. If, however, the saline ext. is treated with enough alc. not to exceed a concn. of 50%, the fluid portion sepd. from the pptd. proteins shows an effect on the ovary but does not produce the growth stimulation. The substance attached to the pptd. protein fraction appears thus to be extremely labile. Expts. were therefore instituted with fresh organs ground aseptically to a sludge. This was always acid and was neutralized by adding 5 g. NaHCO_3 per 300 g. tissue. The mass was centrifuged and washed several times with water. The aq. ext. was electrodialed against H_2O , and CO_2 passed through the undialyzed fraction in the cold ($+1^\circ$). A white ppt. settles out which is removed by centrifuging and washed with water satd. with CO_2 . This is dissolved in a very small quantity of NH_4OH and again pptd. with CO_2 , and this is repeated several times. Upon drying over H_2SO_4 *in vacuo* this substance undergoes a striking change in that it becomes very much less sol. in NH_4OH . The yield of this substance is about 1% of the fresh or 2.5% of the dry organ. The substance is very acid and behaves very much like a globulin by being pptd. by CO_2 from a salt-free soln. The substance gives the biuret but not all the other protein reactions; the Molisch and the Hopkins-Cole tests are neg. as well as the Pb acetate reactions for S. The substance, however, contains much S and P. Of the 9 atoms of S in the mol. 7 are in the form of H_2SO_4 . By leaving the P out of the calcn. the N:S relation is 7:1. The fresh substance dissolved in NH_4OH greatly hastens the coagulation of blood.

S. MORGULIS

Studies on blood coagulation. XX. Inhibition of coagulation by heparin. BERNHARD STUBER AND KONRAD LANG. *Biochem. Z.* 212, 16-21(1929); cf. *C. A.* 22, 2778.—Inhibition of blood coagulation through heparin both *in vivo* and *in vitro* is detd. by the inhibition of the blood glycolysis. XXI. Blood clotting and the fluorine content of blood. BERNHARD STUBER AND KONRAD LANG. *Ibid* 96-106.—The coagulation of blood in Kiel is much slower than in Freiburg. This delayed coagulation is attributed to the fact that in Kiel the blood contains F regularly. The Kiel water supply shows 1.65 mg. F per 10 l. while the Freiburg city water has only 0.28 mg. F per 10 l. In a case of *hemophilia* a high F content was demonstrated in the blood.

S. MORGULIS

Changes in ionic composition of organs under the influence of radiation and of high altitude. A. LOEWY AND L. PINCUSSEN. *Biochem. Z.* 212, 22-34(1929).—Radiation and, even to a greater degree, low barometric pressure, alter the quant. relationships between the K, Ca and Mg in vitally important organs. The alteration is almost invariably due to an absolute increase in the Ca and diminution in the K concn.

S. MORGULIS

Studies on the metabolism of the heart muscle. I. Heart glycogen. MARCEL HAENDEL AND A. MUNILLA. *Biochem. Z.* 212, 35-46(1929).—The glycogen contents of the heart, skeletal muscle, liver and the blood sugar were studied following the intra-peritoneal injection of 2 g. glucose per kg. In control animals the heart contained 0.567%, skeletal muscle 0.248% and the liver 1.2619% glycogen. Digitalin caused a marked fall in the heart glycogen content, but not in muscles or liver. Large doses of ouabain caused a general mobilization of glycogen, while small doses did not affect the muscle glycogen. In either case, however, hyperglucemia was produced. Similarly camphor produced hyperglucemia but the glycogen was generally diminished

only after large doses. Small doses did not alter the heart glycogen content. Caffeine had an effect similar to that of the camphor except that the muscle glycogen was more reduced. KCl causes hypoglycemia though it causes diminution in muscle and liver glycogen. CaCl_2 produces hyperglycemia and a marked drop in heart glycogen. A general diminution in glycogen content follows only large doses. Adrenaline causes a generalized mobilization of glycogen. In normal animals the heart glycogen content was unaffected by insulin contrary to its behavior in the pancreatized animal. Thyroxine had little influence on the heart muscle, but did reduce the muscle and liver glycogen. S MORGULIS

Chemistry of the sex glands. I. The discovery of a substance of the composition $(\text{CH}_3)_2\text{N}_6\text{C}_6\text{H}_{18}\text{O}_5$ in the testes. SIGMUND FRANKEL AND GABRIELE MONASTERIO. *Biochem. Z.* **212**, 61-5(1929).—This substance was obtained in pure crystal form from specially prepd. exts. of testes. Its constitution is yet to be studied. Its m. p. is 279° it contains no amino N, no carboxyl or methoxyl groups, $[\alpha]_D^{25} = +173.9$ S MORGULIS

The excretion of acid in urine during work. III. The excretion of phosphate during work of different intensities. MICHAEL S. RESNICHENKO AND NATALIE P. KOSMIN. *Biochem. Z.* **212**, 87-95(1929).—A definite increase in the P excretion was found only in short, strenuous expts. 0.5 to 0.7 km. running. S MORGULIS

Ammonia formation from amino acids in surviving organs. A. BORNSTEIN AND H. F. ROESE. *Biochem. Z.* **212**, 127-36(1929).—Surviving organs from fasting dogs (liver, lung, extremities) when perfused with blood obtained likewise from fasting dogs cause no alteration in the NH₃ content of the blood or cause a slight diminution. If glycine is added to the perfusion blood the NH₃ content of the blood of the extremity is not changed but that of the liver is increased several times. In the case of the lung there is also an increase in the NH₃, but to a much smaller degree than in the liver. Alanine and asparagine are likewise well deaminized by the liver, but none not so well. The liver deaminizes the offered amino acids very rapidly and very extensively when a large amt. of amino acid is contained in the perfusion blood. S MORGULIS

The decomposition of protein and amino acids of the food measured by the ammonia content of the blood. A. BORNSTEIN. *Biochem. Z.* **212**, 137-48(1929).—Upon intravenous injection of amino acids (glycine, alanine, asparagine) the NH₃ content of dog blood rises considerably within a few min. The urea content of the blood rises somewhat later. When given by stomach the amino acids produce a much less pronounced rise in the blood NH₃ and urea content, and it appears after a delay of an hr. Following a meal of meat similar changes in blood NH₃ and urea content are observed after a period of 4-5 hrs. S MORGULIS

Studies on the action of the hormone of the anterior lobe of the hypophysis. MAX REISS AND KÄTE LANGENDORF. *Endokrinologie* **3**, 161-74(1929).—The sex hormone of the anterior lobe of the hypophysis has the same effect on the genital septum of female dogs and rabbits as has already been noted in mice and in rats. The corpora lutea formed under its influence are genuine lutea bodies. The blood cholesterol is increased in normal female dogs and rabbits, this increase being associated with the ripening of the follicles. In ovariectomized animals this increase in blood cholesterol fails to appear as it also happens when there are no follicles in the ovary. However, a definite effect of pituitrin on the blood cholesterol could not be demonstrated. S MORGULIS

The effect of the anterior lobe hormone on the gaseous metabolism of rabbits. MAX REISS AND K. ANTON WINNER. *Endokrinologie* **3**, 174-9(1929).—No definite effect of the anterior lobe hormone can be established on the gaseous metabolism of rabbits. The respiratory quotient varies only within extremely small limits. S MORGULIS

Experimental studies on the ovarian hormone. ARTHUR V. PROBSTNER. *Endokrinologie* **3**, 338-43(1929).—Periodicity of the hormone formation depends on the presence of a maturing ovum. S MORGULIS

The place of the ovarian hormone in the hormone series. KARL CSEPAL, ADALBERT FORNET AND STEFAN PELLÁTHY. *Endokrinologie* **3**, 361-8(1929).—Menformone resembles insulin in its effect of lowering blood pressure. Quite generally it also influences the vegetative tone of both males and females in the direction of a sympathicohypotony. From the point of view of its action on the blood sugar menformone also is closer to insulin than to adrenaline. Menformone lowers the blood serum Ca but has no effect on the blood reaction. S MORGULIS

Anterior lobe hypophysis implantation in Rhesus monkeys. K. EHRHARDT, H. WIESBADER AND L. FOCSANEAU. *Endokrinologie* **3**, 401-5(1929).—In Rhesus monkeys

menstruation occurs without ovulation and the implantation of the anterior lobe of the hypophysis causes enlargement of the uterus without affecting corpus luteum formation. It is thus possible to sep. in this organism the hormonal action of the ovary from the follicular activity.

S. MORGULIS

Effect of parathyroid extract on the blood picture. ISTVÁN PRILLÁTHY AND JOSEPH V. FERNBACH. *Endokrinologie* 3, 406-12(1929).—Parahormone, like adrenaline or thyroïdin, produces leucocytosis with a great increase in myeloid cells.

S. M.

The effect of anterior lobe of hypophysis on ovaries injured by irradiation. ALFRED WALTER. *Endokrinologie* 4, 1-9(1929).—The ovary of the irradiated infantile mouse reacts to anterior lobe implantation so long as there are still uninjured eggs by formation of corpora lutea, but later when it is made up of only lutein tissue it reacts no longer.

S. MORGULIS

Does insulin affect the thyroid gland? C. F. RÄIHÄ. *Skand. Arch. Physiol.* 58, 8-10(1929). Structural changes in the thyroid gland have been noted in rabbits which have been used over a long time for testing insulin preps.

S. MORGULIS

The influence of diet on the action and metabolism of iron. WALTER ARNOLDI. *Folia Hematol.* 38, 339-54(1929).

JOHN T. MYERS

The individuality of the mammary glands of the cow. JOSEF PROKS. *Proc. 8th World's Dairy Congress 1928*, 296-9; cf. *C. A.* 23, 892. Analyses were made of the milk from each teat of 4 cows, and the max. differences in the consts. of the milk of the individual teats of each cow were as follows: H₂O 0.50-1.40%, fat 0.35-1.35%, albuminoids 0.04-0.35%, lactose 0.07-0.74%, ash 0.01-0.07%, solids not fat 0.13-0.71%, Reichert Meissl no. 0.8-1.8, Wauters Polenske no. 0.6-2.9, sapon. no. 0.6-5.8, I no. (Hubl) 0.49-1.61, refraction at 40° 0.7-1.0. These results show that the mammary glands of the same udder show individuality both from the anatomical point of view and from the point of view of the physiology of the milk formation as regards both the component elements of the milk and the compn. of the fat.

A. PAPINEAU-COUTURE

The cataphoretic velocity of mammalian red blood cells. HAROLD A. ABRAMSON. *J. Gen. Physiol.* 12, 711-25(1929); cf. *C. A.* 23, 2991. The following order of cataphoretic velocity of red blood cells in *M* 15 phosphate buffer at pH 7.35, expressed in μ per sec. per v. per cm., was found: Dog > rat > cat > mouse > monkey = man > guinea pig > opossum > pig > sloth > rabbit. The order was the same in isotonic glucose soln. The velocity is not affected by time of standing (up to 24 hrs.) or by successive washing of the blood cells. Although cholesterol and quartz adsorb gelatin from dil. soln. in phosphate buffer, red blood cells retained their original velocity even after 24 hrs. contact with gelatin soln. Pregnant and nonpregnant white female humans have the same red cell cataphoretic velocity. Severe anemia does not significantly change cataphoretic velocity of the red cells.

C. H. RICHARDSON

Phosphagen in the heart. G. MARTINO AND G. ZANGHÌ. *Boll. soc. ital. biol. sper.* 4, 551-2(1929). Detns. made upon the ox heart show that in the ventricular muscle phosphagen is present in amts. of between 6.5 and 7 mg. %, while in the muscles of the auricle the percentage varies between 4 and 6 mg. %.

G. H. SMITH

Phosphagen in the uterus. V. SIRACUSA. *Boll. soc. ital. biol. sper.* 4, 553-5(1929); cf. *C. A.* 23, 1915. In the dog uterus phosphagen was not found and the phosphoric acid varied between 17 and 34 mg. %, P. Limited work with the human uterus indicated that there may possibly be small quantities of phosphagen in the active uterus, there is none in the resting organ.

G. H. SMITH

Hormone of the hypophysis lipoid. RENZO AGNOLI. *Boll. soc. ital. biol. sper.* 4, 574-8(1929); cf. *C. A.* 23, 875. The ether sol. fraction of an alc. ext. of the hypophysis stimulates deamination.

G. H. SMITH

The relationship between serum calcium and age. ESTHER M. GREISHEIMER, OLGA H. JOHNSON AND MARY RYAN. *Am. J. Med. Sci.* 177, 704-9(1929).—Av. Ca content of the serum was 10.858 \pm 0.049 mg. in 141 women and 10.746 \pm 0.045 mg. in 177 men. It decreases with age, in women averaging 11.8 at 12 yr. and 9.7 at 78 yr., in men averaging 11.6 at 12 yr. and 10.0 at 78 yr.

R. C. WILLSON

Creatine-creatinine metabolism. J. L. BOLLMAN. *Proc. of the Staff Meetings of the Mayo Clinic* 4, 220-1(1929).—On a creatine-free, low-protein diet, the daily excretion of creatinine was not changed by oral or intravenous administration of creatine in amts. comparable to the daily excretion of creatinine. Unchanged creatine was recovered from the urine. Addn. of 10 g. casein to the diet did not produce any change, but 100 g. casein markedly increased the creatinine excretion and reduced the amt. of creatine recovered from the urine. Work was clinical and exptl. with dogs.

R. C. WILLSON

G—PATHOLOGY

H. GIDEON WELLS

Clinical and anatomical study of the lipoidal nephrosis. PAUL GOVAERTS AND R. CORDIER. *Bull. acad. roy. med. Belg.* [5], 8, 510-48(1929).—Nephrosis cannot be explained by an isolated degeneration of the kidney; it is due to grave metabolic disturbances of the body as a whole. This is indicated by a diminution of the osmotic pressure of the blood proteins, on account of hypoalbuminosis. Hence a diet rich in proteins is recommended. R. BEUTNER

The pathogenesis of diabetes. JEAN LA BARRE. *Bull. acad. roy. med. Belg.* [5], 8, 758-88(1928).—The venous blood from the pancreas of a normal dog is introduced by a pancreatic-jugular anastomosis into a depancreatized dog; the hypoglycemia in this latter disappears which proves the presence of insulin in normal blood. The excitation of the right vagus increases the insulin content of the pancreatic blood, which is shown by the hypoglycemia brought about in a depancreatized dog by infusion of this blood. By cross-circulation expts., using the method of Hymans, B. proves that hyperglycemia stimulates the nerve center which regulates insulin secretion. R. BEUTNER

Sugar tolerance in arthritis. II. Arthritis of the menopause. BENJAMIN H. ARCHER. *Arch. Internal Med.* 44, 238-43(1929); cf. C. A. 23, 4503.—In 26 cases of arthritis of the menopause 70% showed diminished sugar tolerance, which may or may not be due to the chronic diseases of the joints present. J. B. BROWN

Inorganic serum sulfates in renal insufficiency. A comparative study of blood urea and creatinine. The effect of diuresis on serum sulfates. F. G. WAKEFIELD. *Arch. Internal Med.* 44, 244-51(1929); cf. C. A. 23, 4239.—In renal insufficiency serum sulfate concn. is increased when blood urea is above 70 mg. per 100 cc. In 5 cases of chronic nephrosis inorg. serum sulfate was normal. J. B. BROWN

Tetany from hyperrespiration. VIRGINIO PORTA. *Boll. soc. ital. biol. sper.* [10], 3, 1282-6(1928).—All the symptoms of tetany may be induced by very profound respiration, the exhalations to be especially complete, voluntarily by man, or by means of a pulmator on animals. A series of tests was made on human beings as well as on cats and rabbits. The CO_2 content was lowered 60% and reserve alk. 14%; the pH increased slightly; the Ca increased slowly, but steadily by reason of increase in Ca proteins, Ca^{++} decreasing (this was the cause of the motor disturbances); glucose increased somewhat and was probably associated with hyperadrenalinemia. Air with 2.5 to 5% CO_2 did not produce tetany, while pure O_2 , unless stopped within 3 or 4 min., produced delirium. Alkalosis is a less factor than the vasomotor disturbances because of the hyperventilation of the lungs. A. W. CONTIERI

The question of sensitiveness to glycerol bouillon. W. KELLER AND W. DÖLTER. *Beitr. klin. Tuberk.* 69, 444-71(1928).—Among 93 tuberculin-pos. children 83 reacted to injections of concd. glycerol bouillon (Höchst) and of 17 tuberculin-pos. adults 16 reacted, while of 112 tuberculin-neg. children none reacted to the bouillon. Microscopically the site of reaction to the glycerol bouillon proved to be tuberculoid in nature as a granulation tissue in the cutis. The basis for this behavior of glycerol bouillon was not definitely detd. H. J. CORPER

The actual reaction of pus in chronic and acute abscesses. B. KOLDAYEV AND B. KUTZENOK. *Beitr. klin. Tuberk.* 69, 472-8(1928).—Colorimetric detn. of the H-ion concn. of pus with the indicators of Clark and Lubs simplified by Krontowski was made in 51 individuals. Closed tuberculous abscesses revealed a H-ion concn. within the limits of pH 6.8 to 7.2, while acute nontuberculous abscesses showed 5.8 to 6.8. Mixed infection shifted the actual reaction of the pus in tuberculous abscesses toward the acid side, while with mild mixed infection as well as in the presence of outspoken cachexia the shift was insignificant. In the presence of severe mixed infection with persistent devitalizing fever and a rich purulent discharge the pH values of acute pus were approached in individual cases. It is believed that the findings can be of practical differential diagnostic value. H. J. CORPER

Intracutaneous injections of perspiration and tuberculosis. E. DORN. *Z. Tuberk.* 51, 134-7(1928).—Stimulated by the Wildbolz urine test D. tested the perspiration of tuberculous individuals for the elicitation of sp. reactions. The perspiration was obtained by means of a syringe from the axilla or brow of the patient and the supernatant fluid used after permitting the solid epidermal material to settle out. Injections were given intracutaneously into the upper arm in 0.2 cc. amts. The expts. were tried on auto- and hetero-donors and of 171 tests 81.3% proved theoretically correct. As with the tuberculin skin test there occurred a local reaction at the site of injection

but general and focal reactions were absent. Pos. reactions as a rule indicated an active tuberculosis in the donor and a neg. the reverse. The diagnosis of an active tuberculosis in the perspiration donor is possible in the majority of moderately severe and severe tuberculous cases and when the recipient is tuberculin hypersensitive. An early diagnosis of active tuberculosis was not possible by means of the intracutaneous injection of perspiration.

H. J. CORPER

Serological studies in experimental yaws. OTTO SCHÖBL. *Philippine J. Sci.* 40, 53-61 (1928). Experiments concerning the yaws antigen which produces a positive Wassermann reaction when injected in suitable experimental animals. OTTO SCHÖBL AND BRUCE A. TANABE. *Ibid* 57-68. Is the Wassermann reaction provoked in Philippine yaws, yaws vaccination specific? ISAO MIYAO. *Ibid* 71-4. Following the subcutaneous immunization with yaws vaccine is the skin tissue proper responsible for the production of Wassermann reaction or do other tissues also participate? *Ibid*

The relation of the Wassermann and the Kahn reactions with regard to treponema antigen. ONOFRE GARCIA. *Ibid* 79-87. Summary of serologic studies in experimental yaws. OTTO SCHÖBL. *Ibid* 89-90. Immunologic relation between yaws and syphilis. OTTO SCHÖBL AND ISAO MIYAO. *Ibid* 91-108. E. J. C.

Studies on dehydration following edema. III. The sedimentation test during the reduction of cardiac edema. ESKIL KYLIN. *Z. ges. expil. Med.* 64, 217-26 (1929); cf. *ibid.* 23, 637.—In cardiac decompensation with edema the sedimentation rate of erythrocytes is generally normal or somewhat prolonged. During loss of the edema the rate accelerated, reaching a max. as the edema disappears, becoming normal gradually after a period of several weeks. K. considers that these variations are due to chemical changes in the plasma, particularly in the protein fraction.

F. L. DUNN

Ketonuria in liver disease. GERHARD SCHERK. *Z. ges. expil. Med.* 64, 281-7 (1929). Acetone and β -hydroxybutyric acid excretion is unchanged in liver disease. Following 10 to 15 g of β -hydroxybutyric acid to patients with liver disease showed no increase in excretion over that observed in normal individuals or in patients with diabetes than liver disease. Ketonuria cannot be used as a test for liver function because other organs in the body can oxidize ketone bodies.

F. L. DUNN

The hydrogen-ion concentration of blood and urine in health and disease. RUDOLF ALINT. *Z. ges. expil. Med.* 64, 288-94 (1929).

F. L. DUNN

Glucolysis in spinal fluid. OTTO J. NIELSEN. *Z. ges. expil. Med.* 64, 522-33 (1929).—The glucolytic process was studied in 37 fluids, 12 of which were normal, 15 from cases of tuberculous meningitis, 1 serous meningitis, 1 brain tumor, 2 uremia. The glucolytic process depends upon exogenous factors. It began usually only after 32 days. Cells and bacteria not glucogenic in themselves did not affect the rate. The H-ion concn. did not influence the rate.

F. L. DUNN

The chemistry of pathological fatty liver. D. YUASA. *Z. ges. expil. Med.* 64, 658-65 (1929).—The I number and the periodine (Margosches) number were detd. for the fat in 51 livers together with the deposit fat. Pathol. changes in liver fat are accompanied by similar changes in deposit fat and Y. concludes that the fatty liver is not due to a simple transfer of deposit fat into the liver.

F. L. DUNN

The mineral content of the blood in malignant and benign tumors. A. SCHEPERS-TINSKY AND M. KAFITIN. *Arch. Gynäkol.* 136, 379-87 (1929); cf. *C. A.* 23, 3967.—The mineral content of the blood was detd. in 60 women with fibroma of the uterus and in 60 women with cancer. In fibroma cases the Ca content was usually at the same level as in normal women. Removal of the fibroma was followed by an increase in the Ca content but not above the upper limit of normal. In cases where the Ca content was high the removal of the fibroma caused a fall to normal. In malignant tumors the Ca content was usually within normal limits but an inconsiderable percentage of cases showed a slight increase. In fibroma the K content was within normal limits in the majority of cases but was somewhat decreased in 35% of the cases. Removal of the fibroma was followed by an increase of K content in those cases in which it was decreased before the operation. In malignant tumors the K content was within normal limits in the majority of cases but was somewhat decreased in 40% of the cases. In fibroma the P content was usually within normal limits. After removal of the fibroma it reached the normal limit if it had been low before. In malignant tumor the P content was noticeably decreased in 70% of the cases. The Na and Cl contents were found within normal limits both in fibroma and in malignant tumor. HARRIET F. HOLMES

Isoagglutination in the newborn and its relationship to icterus neonatorum. GEORG LENART AND STEFAN BIRÓ. *Jahrb. Kinderheilk.* 124, 77-87 (1929); cf. *C. A.* 23, 1955.—An intense icterus neonatorum occurs twice as frequently when maternal and fetal

bloods are incompatible as when they belong to the same blood group. In spite of group identity 5 of 56 maternal sera agglutinated the erythrocytes of their offspring. Atypical isoagglutinins were found in the sera of several infants. It is possible that in some cases agglutination and hemolysis may be due to the existence of autochthonous fetal isoagglutinins, or there may be unrecognized sub-groups in the established blood groups.

The significance of the decrease of sugar in the cerebrospinal fluid in tuberculous meningitis, and its relationship to the lactic acid content and to hydrogen-ion concentration. J. GELDRICH. *Jahrb. Kinderheilk.* **124**, 159-87(1929).—In tuberculous meningitis the sugar in the spinal fluid at first decreases, and then oscillates between 10 and 30%, or in occasional instances rises again to normal heights. On the other hand, lactic acid rises constantly throughout the illness, increasing from 15 to about 120 mg. percent. The increase of lactic acid is probably due to lactic fermentation. From a clinical point of view, the detn. of lactic acid is of more value than that of sugar. Electrometric detn. of the p_H shows that the reaction becomes more acid, reaching a final value of p_H 7.22 to p_H 7.08. A decrease of sugar and an increase of lactic acid are pathognomonic of meningitis, but are present in all meningitides, regardless of etiology.

ELEANOR M. HUMPHREYS

The chemistry of the cerebrospinal fluid. BÉLA STEINER. *Jahrb. Kinderheilk.* **124**, 188-94(1929).—The inorg. P in the normal cerebrospinal fluid varies between 1.4 and 1.6 mg. %. In meningitis the values lie between 1.7 and 3.0 mg. %. In brain tumor cases and in acute encephalitis the P is decreased. These observations gain in diagnostic value because other chem. studies give entirely neg. results. E. M. H.

Immunological studies of the constituents of *Bacillus dysenteriae* (Shiga). KAORI MATSUMOTO and TAKASHI SEKI. *Japan J. Exptl. Med.* **7**, 1-7(1928). Nucleoprotein prep. from autolysates of the dysentery bacillus is toxic and has antigenic potency as detd. *in vitro* and *in vivo*. The non protein residue is non toxic, and while it reacts species-specifically with antibacterial serum, it has no power to incite antibody formation.

ELEANOR M. HUMPHREYS

The mechanism of complement activity in hemolysis. KEIZO NAKAMURA. *Japan J. Exptl. Med.* **7**, 17-42(1928).—The degree of combination of sensitized erythrocyte. with complement is in general in proportion to the concn. of both substances. The hemolytic end-product inhibits this combination in proportion to its concn. The reaction equation derived from observations on the action of complement resembles that derived by Michaelis from observations on the action of saccharase.

ELEANOR M. HUMPHREYS

A biochemical study of the urine of cancer rats. YOSHIO KIMURA. *Japan J. Exptl. Med.* **7**, 113-34(1928).—This study of the chemistry of the urine of rats before and after tumor transplantation indicates an increased destruction of body proteins, paralleling the growth of the tumor. Total N and urea N are increased. Amino acids at first decrease and later increase. The ratio NH_4-N total-N decreases. There is a marked increase of allantoin, indicating an increased destruction of cell nuclei. According to the growth of the tumor, the output of salts rises, and the normal salt ratios are disturbed. The output of H_2SO_4 is but slightly increased, while neutral S shows a marked rise. The P_2O_5 increase parallels that of allantoin.

ELEANOR M. HUMPHREYS

Water loss in the expired air in cholera infantum. ALOIS BRATUSCH-MARRAIN. *Monatsschr. Kinderheilk.* **41**, 122-7(1928). In cholera infantum the diarrhea alone does not account for the great loss of water from the body. The marked increase in the depth of respiration and in pulmonary ventilation is associated with an increased loss of water in the expired air. The normal pulmonary water output of 200-400 g. per day rises to 500-1000 g. per day.

ELEANOR M. HUMPHREYS

The significance of refractometry in the differential diagnosis of pneumonias in childhood. HENRIETTE STAHLBERG. *Monatsschr. Kinderheilk.* **41**, 413-21(1928).—Refractometric determination of serum proteins is of value in the differential diagnosis of pneumonias in childhood. Serum protein is distinctly high in the tuberculous pneumonias, as contrasted with normal or sub-normal values in croupous and broncho-pneumonias. The sedimentation rate of erythrocytes does not parallel the serum protein level, but is increased in all pneumonias in proportion to their severity.

ELEANOR M. HUMPHREYS

Meningeal permeability and the diagnosis of meningitis in childhood. HERMANN ESSELBRÜGGE. *Monatsschr. Kinderheilk.* **43**, 45-53(1929).—Normally, the meninges are only slightly permeable to uranin, the Na salt of fluorescein. In meningitis this substance passes into the spinal fluid in relatively large amts. Uranin is a valuable aid in the early and differential diagnosis of meningitis.

ELEANOR M. HUMPHREYS

The oxygen-lack in experimental dehydration. M. FUKUYAMA. *Monatsschr. Kinderheilk.* 43, 337-40(1929).—By oxygen-lack F. means the amt. of O_2 required to complete the combustion of the intermediate org. substances excreted in the urine. In exptl. dehydration both the total N excreted and the amt. of O_2 required for complete oxidation are increased. Both the autoxidative processes and oxidation in general are impaired in acute dehydration. ELEANOR M. HUMPHREYS

Endemic goiter and its relation to iodine content of food. JAMES A. HAYNE. *Am. J. Pub. Health* 19, 1111-8(1929).—H. gives (1) the results of a recent survey of S. Carolina for goiter, (2) I_2 content of some S. Carolina vegetables, (3) comparison of (2) with the results published by McClendon for vegetables produced in Cal. and Oregon, (4) I_2 content of potatoes from different regions, (5) I_2 content of potatoes in relation to distance from sea, (6) I_2 in S. Carolina wells, springs, streams and city water and (7) I_2 content of potatoes in relation to soil areas. J. A. KENNEDY

Quantitative studies on the action of compound hemolysins. I. Graphical representation of the reaction between amboceptor, complement and blood corpuscles. RUDOLF GAHL. *J. Immunol.* 15, 549-70(1928). G. has developed a method of plotting hemolytic data. It is shown that curves representing the same percentage of hemolysis are parallel as long as the concn. of blood cells in the mixt. is not changed, and can be made to coincide by a shift of 1 or both coordinate axes. The shape of the curves is, therefore, independent of the concn. or titer of amboceptor and complement serum. This conclusion was derived under certain assumptions, the principal one being that the components are individual substances and not mixts. of 2 or 3. A comparison of the shape of such "characteristics" should, therefore, permit conclusions as to the purity of the components used for the tests. **II. Graphical interpretation of the work of previous investigators.** *Ibid.* 571-87. The exptl. results on compound hemolysins obtained by Arrhenius and Manwaring (*J. Infectious Diseases* 2, 460-84(1905)) were plotted by means of the system developed above. The resulting curves were of decidedly different character. Furthermore, when the various exptl. series of Manwaring are combined into a single plot, the various curves coincide in a general way but not as well as might be expected, if the assumptions stipulated above held without restriction over the whole range of the amboceptor and complement values covered by the expts.

III. New experimental material qualitatively discussed. RUDOLF GAHL, NORMAN DAVID AND ALICE KELLNER. *Ibid.* 16, 209-31(1929). One of the zones has been shown to be due to the presence of amboceptor in the complement. Regarding another zone, the thesis is proposed that it is due to the presence of complement in the amboceptor which would imply that heat inactivation, at least as ordinarily conducted, does not destroy all the complement contained in the amboceptor before inactivation. A 3rd zone was considered as representing the reaction between amboceptor and complement uncontaminated by side reactions. It was shown that this zone is utilized in the Wassermann test. It was also shown that the shape of the characteristics within this zone does not vary with the specimen of amboceptor and complement serum. Cross section curves show the typical S-shape observed by Manwaring. This shape is due to the varying resistance of the individual corpuscles toward lysis. The idea advanced in the 2nd part of this paper that the shape of the characteristic curves depends only on amboceptor and complement serum but not on the concn. and character of the blood corpuscles is supported by exptl. evidence. **IV. Quantitative interpretation of the characteristic curves.** RUDOLF GAHL. *Ibid.* 483-508. It is concluded that the complexities of these curves as they are experimentally obtained can be removed and the curves so simplified that they assume forms which are in harmony with the views proposed by Arrhenius on the reaction between hemolytic amboceptor and complement by introducing into the calcn. the assumption that neither heat-inactivated hemolytic amboceptor serum is free from complement nor complement serum from natural amboceptor. Geometrical methods for introducing suitable corrections were developed for this purpose. The application of such methods permits the quant. estn. of the contaminations. Heat-inactivated hemolytic amboceptor serum may, when undiluted, contain complement in quantities not much lower in order of magnitude than the complement serum. Its effect may nevertheless not be noticeable on the Wassermann reaction as long as potent amboceptor serum is used which permits a correspondingly high diln. Application of the law of mass action makes the construction of theoretical systems of characteristic curves possible. Only the exponents of mass law equations det. the shape of these curves. Such curve systems were calcd. under various assumptions regarding the chem. combination between amboceptor and complement and found to present typical pictures characteristic of each reaction. It is shown that when the corrections above referred to are applied to the curves derived from the

law of mass action in the opposite direction, complex curves result which agree with those experimentally obtained within the limits of explt. errors except in the region of complement deviation which the theory is not designed to cover. Rational systems for expressing strength of amboceptor and complement were proposed. J. A. K.

Chemical investigation of biologically active lipoids of tubercle bacilli. RUDOLPH J. ANDERSON. *Proc. Nat. Acad. Sci.* 15, 628-33(1929).—All the various lipid fractions isolated from tubercle bacilli possess the property of stimulating the proliferation of monocytes, epitheloid and giant cells and the subcutaneous injection of these products leads to a formation of tuberculous tissue. The factors responsible for this reaction have been identified as certain liquid satd. fatty acids. The substance possessing the greatest biol. activity is a *d*-rotatory fatty acid of the formula $C_{22}H_{42}O_2$ which has been named *phthioic acid*. J. A. KENNEDY

Effect of heating syphilitic serum and its protein fractions on precipitation reaction. M. NISHIO. *J. Infectious Diseases* 43, 148-55(1929).—Globulin from syphilitic serum, whether unheated or heated for 30 min. at 56°, gives pptn. results with the Kahn test, similar to those given by the same syphilitic serum after heating for 30 min. at 56°. Unheated albumin from syphilitic serum prevents or reduces pptn. given by the globulin. This property is not manifested when the albumin is heated for 30 min. at 56°. The protection to pptn. exerted by unheated albumin appears to be an inverse function of the concn. of the reacting substances of the serum and antigen. JULIAN H. LEWIS

Proteolytic enzymes in serum. XII. The significance of complement in blood coagulation. HANS J. FUCHS. *Z. Immunitäts.* 58, 14-21(1929); cf. *C. A.* 22, 2793.—Instead of using colloidal $Ca_3(PO_4)_2$ for the isolation of proserozyme as described by Bordet (*Ann. inst. Pasteur* 34, No. 9 (1920)) a colloidal suspension of $Mg(OH)_2$ was used. The adsorbed enzyme can be liberated with CO_2 . Plasma made uncoagulable with colloidal $Mg(OH)_2$ is devoid of complement action, but if coagulability is restored by the addn. of proserozyme, complement action is also restored. If proserozyme is added to enzyme-free plasma and the return of coagulability and complement action tested in the same vessel it is found that coagulation returns first and then hemolysis from the restored complement. JULIAN H. LEWIS

The antigenic function of human red blood cells of the various groups. KOJI OKABE. *Z. Immunitäts.* 58, 22-53(1928).—Antisera from rabbits immunized with human red cells of group O contained chiefly species sp. agglutinins. Although there were individual variations, cells of group O were agglutinated stronger in most cases. The possibility of cells of group O being the carriers of species sp. receptors is discussed. Such antisera either did not react with alc. red cell exts. or did so without group specificity. Immunization against group A red cells produced 3 types of antisera: (1) in which there was only species sp. agglutinins; (2) in which there was a specificity for group A cells; (3) in which there dominated agglutinins for group A, but in which there were also agglutinins for group B. The same relations existed when tested with alc. exts. of the red cells except that the species sp. antisera did not react with the exts. Antisera sp. for group A red cells reacted with heterogeneous alc. exts. Group B red cells also produced 3 types of antisera as follows: (1) those that contained species sp. antibodies; (2) those that reacted both with groups A and B; (3) those that contained agglutinins for group B. Beef serum is chiefly dominated with agglutinins for human red cells of group A, although some types contain agglutinins for group O. JULIAN H. LEWIS

Explanation of antiviral action. FRITZ SCHWEINBURG. *Z. Immunitäts.* 58, 53-78 (1928).—A crit. study is made of Besredka's antiviral from which it is concluded that this substance has no sp. action. After repeated inoculation and filtration of the culture medium a stage is reached where the filtrate not only inhibits the growth of bacteria but actually injures them. This action appears sooner according to the degree of departure of the H-ion concn. from the normal reaction, either to the acid or alk. side, and appears sooner for the homologous bacteria. The toxic action of the filtrates is due not only to an exhaustion of the culture medium but also to the development of injurious substances either from the medium itself or from the bacteria. The therapeutic action of these products is due to the unsp. curative action of foreign proteins. JULIAN H. LEWIS

The agglutinating and hemolytic action of serum on red cells changed by bacteria. Y. HIROTA. *Z. Immunitäts.* 58, 78-92(1928).—The organism isolated by Friedenreich (cf. *C. A.* 22, 3448) acts on normal human red cells so that they are agglutinated by agglutinins not demonstrable with normal cells. Low temps. are more favorable for this type of agglutination. The organism acts on cells of lower animals as well as those of man and makes them agglutinable by normal serum of species different from those

of the red cells. The abnormal agglutinability of red cells from lower animals is accompanied by an increased ease of hemolysis. The mechanism of the action of this organism, though not understood, is discussed. JULIAN H. LEWIS

Ultra-violet radiation of tetanus toxin, ricin, hemolytic complement and fatty acids. JOHANN SCHUBERT. *Z. Immunitäts.* 58, 106-22(1928).—Dried tetanus toxin is weakened by ultra-violet light almost as much as when in soln. When guinea pig complement is sepd. into its component parts it is found that the end piece, whether dry or in soln., is only slightly affected by ultra-violet light, while the middle-piece is very quickly destroyed when in soln. If the middle-piece is radiated while only moist it can be reactivated under certain conditions. Fatty acids and lipoids which are hemolytic when in colloidal soln. lose this property when radiated. JULIAN H. LEWIS

Antiprotein and antitoxin precipitins. E. HOEN, L. CHERTKOV AND V. ZIPP. *Z. Immunitäts.* 58, 143-58(1928).—Pptg. antisera obtained by the usual methods of giving 3 or 4 injections contain a relatively low titer of antibodies and can be titrated only by making dilns. of the antigen. However, if the immunizing process extends over a period of 6 to 8 months the antiserum has a high concn. of antibodies and can be titrated by making dilns. of the antiserum just as when antidiphtheria serum is titrated by the precipitin method. JULIAN H. LEWIS

The mechanism of chemotherapeutic curative processes. R. SCHNITZER AND W. SILBERSTEIN. *Z. Immunitäts.* 58, 159-72(1928).—Trypanosomes that are resistant to a chemotherapeutic agent disappear from the circulation of mice after treatment with the chemotherapeutic substance provided the mice were infected with both resistant and normal strains of trypanosomes which are immunologically identical. If such infected and treated mice develop a latent infection usually the resistant organisms are found in the circulation. These facts are given in support of the idea that chemotherapeutic cures are due not only to the action of the chemotherapeutic substance but also to an immunological factor. Latent infections are due to the development of a serum-fastness as well as a drug-fastness. JULIAN H. LEWIS

The antigenic structure of organ lipoids. A. J. WEIL. *Z. Immunitäts.* 58, 172-80(1928).—Antisera for organ lipoids obtained by immunization with alc. exts. of organs and hog serum react with various organ lipoids but with quant. complement fixation tests a certain amt. of relative organ specificity can be shown. JULIAN H. LEWIS

The relation of brain lipoids and their antisera. F. HEIMANN AND J. STEINFELD. *Z. Immunitäts.* 58, 181-92(1928).—Antisera for brain lipoids show a relative organ specificity toward either aq. or alc. exts. of organs. The specificity is less marked if the reactions are made with antigens to which cholesterol is added. JULIAN H. LEWIS

The antigenic nature of alcoholic extracts of tubercle bacilli. F. WEIGMANN AND W. LIESKE. *Z. Immunitäts.* 58, 222-43(1928).—See C. A. 22, 2611. J. H. L.

The physico-chemical relations of agglutinins. LEO OLITZKI. *Z. Immunitäts.* 58, 244-54(1928).—By fractional pptn. of the globulin of immune sera no difference in the precipitability of O and H agglutinins could be demonstrated. Immune sera freed of euglobulin showed a higher resistance of the H agglutinin to heat. The O agglutinin is very sensitive to pH changes while the H form is resistant. CHOH has a more destructive action on the agglutinins of an immune serum the more concd. the serum is, while heat has the same action irrespective of the concn. of the serum. This indicates that CHOH acts primarily on serum globulin while heat acts directly on the agglutinin. JULIAN H. LEWIS

Thrombocytobarin against bacteria. M. N. LEBEDEWA. *Z. Immunitäts.* 58, 255-63(1928).—Only spirilla and vibrios show the ability to incite the formation of thrombocytobarin on immunization. This antibody is sp. Dead or injured organisms lose their power to be laden with blood platelets in the presence of thrombocytobarin. JULIAN H. LEWIS

Influence of the surrounding temperature on the toxic effect of foreign serum and red cells on cold-blooded animals. K. A. FRIEDR. R. E. MESSIK AND E. M. SCHACHUNJANZ. *Z. Immunitäts.* 58, 263-70(1928).—Foreign serum and red cells are much more toxic for frogs at room temp. (8°) than at 20°. With red cells this apparently is due to an increased phagocytosis and intracellular destruction at the higher temp. No hemolysis occurs in the circulation or in frog serum at 37°. The increased toxicity of serum is due to an increased lability of the cell and blood colloids at higher temps. Active physico-chem. substances change the grade of dispersion of frog serum colloids much easier and quicker if the temp. is raised. JULIAN H. LEWIS

The specific antigenic function of organs. E. WITEBSKY AND J. STEINFELD. *Z. Immunitäts.* 58, 271-96(1928).—The injection of a brain emulsion into the rabbit produces an antiserum which is highly organ sp. and only slightly species sp. Such a

serum reacts not only with the homologous brain tissue but also with the brain tissue of all other animals, either in its native state or after boiling. An exception is beef brain which produces an antiserum which reacts only with native beef brain. Kidney and liver tissue produces chiefly species sp. antisera. Heat destroys the reacting power of these tissues. Another exception is that of beef liver which produces an antiserum that is chiefly organ sp. and which will react with boiled beef liver. With the exception of anti-beef brain sera, anti-brain sera react with alc. exts. of brain as well as with aq. exts. Anti-kidney sera have no lipid antibodies. Anti-liver sera usually contain antibodies which react with lipoids in general, although some contain either organ or species sp. antibodies. Hemolysins and serum precipitins are not necessarily produced by organ immunization. They are never found in anti-brain sera. All rabbits do not produce organ antibodies.

JULIAN H. LEWIS

The antigenic function of the crystalline lens. E. WITEBSKY. *Z. Immunitäts.* 58, 297-311(1928).—Immunization with cryst. lens produces organ sp. antisera which react with aq. and alc. exts. of the lens of all animal species. The injection of alc. exts. of beef lens combined with hog serum produces an antiserum which reacts with lipoids in general and without organ sp. antibodies. The alc. ext. alone produces no lipid antibodies. Guinea-pig lens and brain contain organ sp. lipoids and the Forssman heterogenic antigen.

JULIAN H. LEWIS

The characteristics of the flocculation in mixtures of toxin and antitoxin. M. LURIE, A. ROSENBLATT AND N. KOSSAREW. *Z. Immunitäts.* 58, 448-60(1928).—An explanation is sought for abnormal results in the flocculation titration of diphtheria antitoxin. Most of them arise from physico-chem. alterations of the bouillon in which the toxin is produced. Over-heating of the bouillon, sterilization at a p_H of 5.5 and lower, putrefactive changes in meat from which the bouillon is made, the nature and concn. of electrolytes all have marked influences on the results of the flocculation test. With anaphylaxis tests it can be shown that the flocculate contains serum as well as toxin proteins.

JULIAN H. LEWIS

The role of the reticulo-endothelial system in the activation of chemotherapeutic substances. I. L. KRICHEVSKII. *Z. Immunitäts.* 59, 1-16(1928).—The spleen, through its reticulo-endothelial system, takes up chemotherapeutic substances and gives them off gradually into the circulation. In the absence of the spleen active adsorbing substances, such as agar and the infecting organisms themselves, when injected along with the chemotherapeutic substances may take up the drugs and thus replace the function of the spleen. This activating action of the reticulo-endothelial system is independent of its protective action against infection.

JULIAN H. LEWIS

The relation of group specific structures in man and animals. L. HIRSZFELD AND W. HALBER. *Z. Immunitäts.* 59, 17-51(1928).

JULIAN H. LEWIS

Production of antibodies after blockade of the reticulo-endothelial system. W. JELIN, O. ROSENBLATT AND S. BRINN. *Z. Immunitäts.* 59, 52-65(1928).—Several different colloidal substances were used to produce blockade and to det. their effect on antibody production for various antigens. In general there was an inhibition, indicating the active role that the reticulo-endothelium system plays in immunization.

JULIAN H. LEWIS

The thermostability of agglutinins. L. SILBER AND NIKOLSKAJA. *Z. Immunitäts.* 59, 66-73(1928).—Heat does not affect agglutinins when the serum is heated in the presence of Bayer 205, HCl and other substances which retard coagulation.

JULIAN H. LEWIS

Reaction speed of toxin and antitoxin in fractional saturation. S. SCHMIDT. *Z. Immunitäts.* 59, 82-129(1928).—A study of the Danysz phenomenon in which the Ramon flocculation test was used to det. neutralization.

JULIAN H. LEWIS

The protective action of antipyrine against anaphylactic shock. MOKICHI MATSUDA. *Z. Immunitäts.* 59, 319-25(1928).—Phys. or chem. treatment of guinea pigs does not in most cases protect against anaphylactic death. Adrenaline, $CaCl_2$ and concd. NaCl are not const. in their protective action. The intravenous injection of $1/2$ the lethal dose of antipyrine 5-10 min. before the intravenous injection of antigen protects sensitized guinea pigs from about 5 lethal doses of the antigen.

J. H. L.

The serozyme content of blood platelets, a new coagulation theory. HANS J. FUCHS. *Z. Immunitäts.* 59, 424-33(1928).—Blood platelets contain serozyme and cytozyme. Serozyme plus an excess of cytozyme has no complement action. Thrombin formation resulting from blood platelet disintegration occurs quicker than with the components from the circulating blood because of the "optimal preformed" conditions in the former and the presence of antiprothrombin in the latter.

JULIAN H. LEWIS

Isohemolysin in human sera. I. Reactivation. II. The relative strength of

α - and β -lysin. OLUF THOMSEN AND ALEX THISTED. *Z. Immunitäts.* 59, 479-80, 491-500(1928).—Isohemolysins have the same systematic relations as the isoagglutinins. They must be demonstrated with fresh sera and fresh red cells. They have a comparatively low titer. Isohemolysin that has been inactivated by heat or by standing can be reactivated with guinea-pig serum or human serum, although in the latter case one may encounter antihemolysins. Sera of the A- β group are not as active as those of the B- α group. In the O $\alpha\beta$ group the α -component is more active than the β -component.

JULIAN H. LEWIS

Preparation of a syphilitic antigen from *Sp. pallida*. R. R. HOELTZER AND W. J. POPOFF. *Z. Immunitäts.* 59, 501-9(1928).—Rabbits immunized with an ext. of spirochetes after the method of Klopstock gave a pos. Wassermann reaction. The reaction was best obtained with an alc. ext. of the spirochetes. This ext. also gave pos. reactions with human serum if pos. reactions were obtained with the usual Wassermann antigens, but neg. sera also gave pos. reactions.

JULIAN H. LEWIS

The complement titer of guinea pigs on acid and alkali diets. W. E. HUGHES AND H. ZAIN. *Z. Immunitäts.* 59, 517-20(1928).—Acid or alk. diets had no effect on the complement titer. In one case on an acid diet (hay) in which a lipemia developed there was a decrease in the titer.

JULIAN H. LEWIS

The question of the oxidation of glucose in phlorhizin glucosuria. WALTER M. BOOTHBY, CHARLES M. WILHELMJ AND H. ELLIS C. WILSON. *J. Biol. Chem.* 83, 657-79(1929).—"After several days of complete phlorhization the basal metabolic rate in dogs is markedly elevated and may reach 90% above the normal rate. The administration of glucose to the completely phlorhizinized dog causes a definite decrease in the high level of heat production and a definite rise in the respiratory quotient. If this rise is taken as indicating an increase in the oxidation of glucose, it is found that 18-25% of the ingested glucose is oxidized in 5-7 hrs. In phlorhizinized dogs, when proper precautions are taken, the amt. of glucose accounted for by oxidation and excretion in the urine will not exceed the amt. given; therefore, the results from these expts. do not yield evidence in favor of the assumption that carbohydrate is formed from fat."

A. P. LOTHROP

Muscle phosphorus. III. The distribution of acid-soluble phosphorus compounds during parathyroid tetany. H. A. DAVENPORT, H. H. DIXON AND S. W. RANSON. *J. Biol. Chem.* 83, 741-6(1929); cf. *C. A.* 23, 1654.—No changes were found in acid-sol. P content or in the partition of P compds. in the gastrocnemii of parathyroidectomized dogs and dehydration of these muscles was not demonstrable. Changes in phosphate metabolism during parathyroid tetany involve a source of P other than that of striped muscle.

A. P. LOTHROP

The chemical analysis of bacteria. The chemical aspects of immunity. GEORGES LOEWY. *Presse méd.* 37, 752-3(1929).—A general review.

A. E. MEYER

Problems in pathological fat formation. II. The problem of lecithin. GEORG, ROSENFELD. *Biochem. Z.* 211, 270-5(1929); cf. *C. A.* 23, 5235.—The accumulation of lecithin in the livers of P-poisoned animals is considered due to migration of lecithin from body depots.

S. MORGULIS

The mitogenetic behavior of blood from carcinoma patients. LYDIA GURVICH, S. ZALKIND, A. LAPZINSKII AND A. MARTINOV. *Biochem. Z.* 211, 362-72(1929).—The blood of cancer patients as well as of cancerous mice loses its mitogenetic activity; this is attributed to an inhibition of the enzymic processes upon which the activity of the blood depends.

S. MORGULIS

The erythrocyte with special reference to punctate basophilia, diffuse polychromasia and reticulation. W. E. COOKE. *Folia Haematol.* 38, 194-7(1929).—It is probable that the stainable substance is not nuclear but a hemoglobin compd., and that the above conditions vary only quantitatively. When these conditions occur under ordinary staining conditions they point to increased permeability, or a defect in the lipid envelope of the erythrocyte rather than to immaturity.

J. T. M.

The blood picture and the eosinophilia in trichinellosis. G. WEINDRACH. *Folia Haematol.* 38, 380-4(1929).—It is suggested that the eosinophilia may be due to a paralyzing effect of the toxin produced by the parasite on an internal secretion of the spleen.

JOHN T. MYERS

Studies on carbon dioxide. V. The mechanism responsible for the preserving action of carbon dioxide on diphtheria toxin. WAYNE N. PLASTRIDGE AND LEO F. RUTTER. *J. Bact.* 18, 101-5(1929); cf. *C. A.* 23, 4965.—Diphtheria toxin may be preserved over comparatively long periods of time at a temp. of 37° when placed under CO₂, providing sufficient CO₂ to produce an acid reaction is not present. Within the limits of p_H 7.0 and 9.0, the lower the H-ion concn. of the toxin soln. the more rapid

is the rate of destruction of the toxin by mol. O in the absence of CO_2 . The toxicity of filtrates stored under N decreases less rapidly than the toxicity of solns. having the same reactions but stored under a small quantity of air, but the rate of destruction under N is greater than under CO_2 . The opt. p_{H} for the preservation of toxin is 7.0. The preserving effect of CO_2 is due to its control of the p_{H} and prevention of oxidation by mol. O.

JOHN T. MYERS

Studies on dental caries, with special reference to the aciduric organisms associated with the process. I. Isolation and description of the organisms. TOSHIKI MORISHITA. *J. Bact.* 18, 181-98(1929).—High acid-tolerating organisms are almost always present in tooth enamel and saliva of persons with dental caries. They may produce enough acid to cause decalcification of enamel *in vitro* but this has not been substantiated *in vivo* as yet.

JOHN T. MYERS

The activating action of a phenol-alcohol mixture on lipid antigens. H. SACHS AND G. SOLLAZZO. *Zentr. Bakt. Parasitenk.*, I Abt., 112, 325-35(1929).—Heterogeneous lipid antigens so finely dispersed that they do not react with antisera may be made to bind complement strongly by the addn. of a mixt. of 2% phenol in alc. Phenol-alc. dild. with NaCl soln. will serve as antigen in the Wassermann reaction, because it partially flocculates the serum lipoids, rendering them antigenic. J. T. M.

Is the sterilization of the organism by the use of therapeutic doses of "Naganol" (Bayer 205) possible in trypanosomiasis of the camel? S. A. AMANSHULOV, P. N. ARBUZOV AND A. SHURAVLEV. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 36-8(1929).—Some trypanosomes become tolerant.

JOHN T. MYERS

A new method of producing bacterial vaccines. J. VIGNATI. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 71-3(1929).—Bacterial suspensions were made in 5 to 10% CuSO_4 solns., allowed to stand at room temp. for 4 to 6 hrs., centrifuged and dild. with the following soln.: $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ 25 g., Na_2SO_3 2.5 g., distd. water 1000 cc. These vaccines were just as antigenic and less toxic than heat-killed cells. J. T. M.

Antibody production by antigens contained in the cell membrane. ANNA-LISA ANNELL. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 122-30(1929).—Living or killed culture of the cholera vibrio in collodion sacs placed in the peritoneal cavity of rabbits produced agglutinins and lysins. Tubercle bacilli produced hypersensitization. J. T. M.

The prevention of bacterial panagglutination of erythrocytes (Thompsons' phenomenon), a source of error in blood grouping. LILY SANDSTRÖM. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 256-61(1929).—A concn. of 0.01 to 2.0% of formalin will prevent this non-sp. agglutination of human erythrocytes.

JOHN T. MYERS

The nature of serum hemolysins. L. GÓZONY AND F. HOFFENREICH. *Zentr. Bakt. Parasitenk.*, I Abt., 113, 277-84(1929).—Hemolytic serum of high titer was extd. with acetone and ether, dried, extd. overnight with distd. water and centrifuged. The aq. ext. was adsorbed with a suspension of cholesterol and erythrocyte lipoids, centrifuged and the lipoids were removed by washing alternately with acetone and benzene 2 or 3 times. Two types of needle-like crystals remained after this washing, which could be sepd. by slow centrifugation; a large type which hemolyzes at a diln. of 1:2,000,000 and a small type which hemolyzes at 1:500,000. Neither gave protein reactions. They behave like lipases.

JOHN T. MYERS

Humoral instability: causes, effects and remedies. AUGUSTE LUMIÈRE. *Rev. gén. colloïdes* 7, 158-65(1929).—Purely speculative.

GEO. H. SMITH

Serological studies on blood proteins. TANDO MISAO. *Japanese J. Med. Sciences*. VI. *Bacteriology and Parasitology* 1, 1-51(1929).—Plasma fibrinogen, globulin, albumin and hemoglobin are antigenic in decreasing strengths as here given, plasma and whole serum being intermediate between globulin and albumin. Each of these four proteins is specific, hemoglobin being very distinct from the 3 plasma proteins, which are only relatively specific, the globulin coming between the albumin and the fibrinogen and being especially related to the latter. All four show species specificity but the hemoglobin less than the plasma proteins. The "artificial globulin" of Moll is also antigenic, and has its own specificity, nearer the albumin than the globulin. Antiserum against the most carefully purified hemoglobin produces not only precipitins for hemoglobin but also for plasma proteins, which M. attributes to an assumed transformation of hemoglobin into plasma proteins after injection. Globin is about as actively antigenic as hemoglobin, with the same species specificity, but shows chem. specificity from hemoglobin; it is not particularly toxic.

H. G. WELLS

No lead in tumor tissue after intravenous injection of colloidal lead. M. C. RAINHARD AND K. W. BUCHWALD. *J. Cancer Research* 13, 239-41(1929).—Colloidal lead (diapsorol or phosphate) was injected intravenously into mice with spontaneous tumors, which were later removed and examd. for Pb by chem. and spectral analysis.

The results were entirely negative. This is in accordance with the results of Martland and Sochocky.

Lactic acid formation in tumor tissue. HELEN R. DOWNES. *J. Cancer Research* 13, 268-82(1929).—When tumor tissue from human cases is incubated with nutrient soln. contg. glucose, lactic acid is formed in widely varying amts., but nearly always in excess of the amt. that would be formed by normal muscle or embryo hash. When rat tumor tissue is subjected to conditions of temp. or p_H that render it incapable of being transplanted, the lactic-acid-forming ability of the tissue is not altered. Radiation *in vivo* and *in vitro* does not affect the lactic-acid-forming ability of animal tumors. Rat tumors which can be kept on ice for a week and still be successfully transplanted lose their lactic-acid-forming power rapidly with time, and have lost it very nearly completely at the end of 7 days. Glucose, maltose and mannose serve tumor tissue equally well as lactic-acid precursors. Fructose and hexosephosphate are less readily available, and sucrose, lactose, galactose and glycogen cannot be used by tumor tissue at all.

H. G. WELLS

Serological differentiation of steric isomers (antigens containing tartaric acids). II. K. LANDSTEINER AND J. VAN DER SCHEER. *J. Exptl. Med.* 50, 407-17(1929); cf. *C. A.* 22, 3927.—In continuation of studies on the stereochem. specificity of serum reactions, antigens were examd. contg. the acyl radicals of the *l*-, *d*- and *meso*-tartaric acids. Immune sera can readily be obtained which differentiate sharply the 3 antigens identical in every other respect but possessing stereoisomeric groups. Since the tartaric acids by their chem. constitution belong to the same class of substances as sugar acids the results have a bearing upon the question of the specificity of natural antigens contg. carbohydrates such as have been described by Avery and Heidelberger. Heating ≈ 5 g. tartaric acid and 13.8 g. $p\text{-O}_2\text{NC}_6\text{H}_4\text{NH}_2$ at 170° gives approx. 12 g. *p*-nitrolar-tranilic acid; the *l*-deriv., yellow, m. $211-2^\circ$, $[\alpha]_D^{25} -120^\circ$ (1% in MeOH); *d*-deriv., m. $212-3^\circ$, $[\alpha]_D^{25} 120^\circ$ (1% in MeOH); *meso*-deriv., m. $193-4^\circ$. Reduction with Zn and HCl give the corresponding *p*-NII, derivs. which do not m. at 285° ; the *l*-deriv. has $[\alpha]_D^{25} -98.6^\circ$ (480 mg. + 2.6 cc. *N* HCl made up to 15 cc.); the *d*-deriv. has $[\alpha]_D^{25} 99.2^\circ$ under the same conditions. The diazo compds. from these were coupled with proteins as in the earlier paper.

C. J. WEST

Antibody formation by polysaccharides. SHOJI NISHIMURA. *J. Exptl. Med.* 50, 419-29(1929).—By complement-fixation tests it has been clearly demonstrated that the sera of rabbits immunized with inulin, sol. starch and dextrin contain sp. antibodies. All these immune sera gave a negative pptn. reaction. The kind of dextrin which has a constitution very near to that of starch has an antigenic property, but those in a state of further decompn. do not give rise to antibodies. All of the 3 kinds of polysaccharides have power to produce antibodies without any vehicle. Dextrin is the only one of the 3 that gives rise to immune bodies more readily when pig serum is added to it. Regarded as antigens, inulin stands first and sol. starch and dextrin are next in order. All 3 kinds of polysaccharides that were employed gave negative protein color reaction; all of them, however, contained N. It is suggested that in the production of immune bodies by these 3 kinds of polysaccharides, proteins might play the part of the vehicle. This is, however, still to be detd.

C. J. WEST

Acido-ammoniuria in acidosis and alkalosis. L. BETHOUX AND P. MOUNIER. *Arch. mal. app. diges.* 19, 67-90(1929); *J. Am. Med. Assoc.* 92, 1638.—The term acido-ammoniuria is used to express the total acidity of urine, comprising the acidity due to acid PO_4 , org. acids and combined NH_4 salts. It is detd. by titrating urine with 0.1 *N* NaOH after the addn. of formaldehyde and multiplying the result by 10 to express it in *N* NaOH per l. In normal adults on a mixed diet, it averages 80 cc. *N* NaOH per l. On a meat diet, in fasting or inanition, in extreme muscular fatigue and in pregnancy, it increases physiologically up to 100. It is higher in children than in adults. On a vegetable diet and after intake of alkalis or org. acids it decreases to 50. The relation between acido-ammoniuria and the concn. of the urine, called the acido-ammoniuria coeff., is used to express the degree of acidosis. In normal persons this is 5; in slight acidosis it is 6-8, medium acidosis 9-11 and severe acidosis above 12. R. C. W.

Spectrographic chemical analysis [of Rb in blood] (RAMAGE) 7.

H—PHARMACOLOGY

A. N. RICHARDS

The results obtained by trypanoxyl in the treatment of chronic human trypanosomiasis. F. VAN DEN BRANDEN. *Bull. acad. roy. méd. Belg.* [5], 8, 332-41(1928).—

Trypanarsyl is a drug which has the same chem. constitution as tryparsamide. B. uses it with excellent success in 149 cases of chronic trypanosomiasis in the Belgian Congo.

R. BEUTNER

Opium addiction. VII. A comprehensive study of the scopolamine treatment for morphine addiction. ARTHUR B. LIGHT AND EDWARD G. TORRANCE. *Arch. Internal Med.* 44, 194-203(1929); cf. C. A. 23, 4506.—The changes in morphine addicts following scopolamine treatment include: loss of wt., temp. rise, albuminuria, slight leucocytosis, concn. of blood, rise in blood p_H and lactic acid, and fall in CO_2 capacity. Numerous other tests, including complete blood analysis, showed no changes. J. B. B.

Blueberry leaf extract overdosage. LEONARD B. SHPNER. *Arch. Internal Med.* 44, 204-8(1929).—Excessive doses of blueberry leaf ext., "myrtomel," when administered orally to partially pancreatectomized dogs are non-toxic. J. B. BROWN

Toxic cirrhosis of liver due to cinchophen. HERBERT S. REICHLE. *Arch. Internal Med.* 44, 281-8(1929).—Two new cases of cinchophen toxicosis are described, along with 47 cases reviewed from the literature. The therapeutic use of this drug should be reevaluated. J. B. BROWN

"Noctal and Pernocton." III. Behavior in the organism. FR. BOBDECKER AND H. LUDWIG. *Arch. expl. Path. Pharmacol.* 139, 353-6(1929); cf. C. A. 19, 1311.—"Noctal" (5-isopropyl-5- β -bromoallylbarbituric acid) and "Pernocton" (5-*sec*-butyl 5- β -bromoallylbarbituric acid) are chiefly converted in the animal organism to acetylonyl compds. (found to be non-toxic). The corresponding malonylureidoacetic acids (into which "Noctal," "Pernocton" and their acetylonyl compds may be changed) are also non-toxic. IV. The determination of the activity of similar barbituric acids. *Ibid* 357-60.—The β -bromoallyl group as a substituent group in the synthesis of highly active hypnotics is not alone important. The following compds., tested on rabbits and dogs in doses of 0.025-0.04 g. per kg., are also strong hypnotics: 5-isopropyl-5- γ -bromoallyl-, 5-isopropyl-5- β -chloroallyl-, 5-isopropyl-5- β , γ -dibromoallyl-, 5-di-(β -bromoallyl)- and 5,5-di-(β -chloroallyl)-barbituric acids. V. The influence of the structure of the alkyl group on the activity. *Ibid* 361-73.—Barbituric acids having an asymmetric C atom in a branched alkyl substituent (the "Pernocton" type) are the most active of all previously known hypnotics with respect to dosage and rapidity with which narcosis sets in. The physiol. and pharmacol. properties of "Pernocton" were investigated in detail.

B. C. BRUNSTETTER

The antagonism between adrenaline and ergotamine. ULF v. EULER. *Arch. expl. Path. Pharmacol.* 139, 373-8(1929).—Thunberg's methylene blue technic was used to demonstrate that ergotamine tartrate and ergotoxine phosphate in concns. of about 10^{-12} g. increase tissue oxidation. The effect of adrenaline, which strongly increases tissue oxidation, is completely annulled by doses of ergotamine of the same order of magnitude (10^{-10} - 10^{-12} g.).

B. C. BRUNSTETTER

Remarks on the paper of E. Geiger and E. Schmidt: "Influence of adrenaline on re-formation of sugar. E. WERTHEIMER. *Arch. expl. Path. Pharmacol.* 139, 378-80(1929).—Polemical. Cf. C. A. 23, 207.

B. C. BRUNSTETTER

Influence of adrenaline on re-formation of sugar. Answer to previous remarks of E. Wertheimer. E. GEIGER AND E. SCHMIDT. *Arch. expl. Path. Pharmacol.* 139, 381-2(1929); cf. preceding abstr.

B. C. BRUNSTETTER

The effect of diethylin on the circulation. U. G. BIJLSMA AND L. W. VAN ESVELD. *Arch. expl. Path. Pharmacol.* 144, 32-45(1929).—Diethylin (diethyl ether of glycerol) causes a rise which can be long sustained in blood pressure. This rise comes from a stimulation of the vasomotor center in the medulla oblongata. The effect of diethylin on the heart and blood vessels is small.

B. C. BRUNSTETTER

Are pentoses utilized in the animal organism? V. HENRIQUES AND A. ROCHE. *Compt. rend. soc. biol.* 100, 846-9(1929).—Arabinose ingested (2 g./kg.) or intravenously injected (1 g./kg.) into rabbits kept at const. temp. and anesthetized by urethan caused an increase in the respiratory quotient. Neither arabinose nor xylose can be substituted for glucose as a restorative in insulin hypoglycemia convulsions. B. C. B.

Glucosuria and insulin. GEORG FRICKE. *Z. ges. expl. Med.* 64, 81-94(1929).—The injection of insulin into normal or pancreatectomized dogs will produce a glucosuria at lower blood sugar levels than when no insulin is given owing to the action of insulin on the renal threshold.

F. L. DUNN

The action of amines. H. W. KNIPPING AND J. STEIGER. *Z. ges. expl. Med.* 64, 594-620(1929).—The total metabolism in dogs was detd. following the administration of the following amines: adrenaline, acetylcholine, histamine, atropine, pilocarpine, thyroxine, tetramethylenediamine, tetrahydronaphthylamine and methylguanidine. In addn. certain bacterial emulsions and amino acids were studied.

F. L. DUNN

The effect of tetronal on the production of hematoporphyrin in the urine. FREDERICK G. GERMUTH. *Indian Med. Gaz.* 64, 491-2(1929).—The general relation existing between sulfonal, trional and tetronal as to their property of accelerating the production of hematoporphyrin in urine is in the proportion, 1.00 sulfonal : 1.34 trional : 1.56 tetronal. Apparently, the production of the porphyrin in urine is considerably influenced by the molecular alkyl structure of the sulfone ingested. F. G. G.

A case of accidental poisoning with barium sulfide. BHUPAL SINGH. *Indian Med. Gaz.* 64, 506-7(1929).—Depilatory powder consisting of 1 part BaS and 8 parts washing earth produced definite symptoms of poisoning. There was complete recovery following administration of $MgSO_4$ soln. FREDERICK G. GERMUTH

The bismuth treatment of carcinoma according to the method of H. Kahn. FRITZ LASCH AND ALFRED NEUMANN. *Klin. Wochschr.* 8, 1021(1929).—The combination of Bi and x-ray therapy may give rise to a temporary improvement, but the outcome of the disease is inevitably fatal. MILTON HANKE

The relation between the liver function and the blood-sugar content. III. The influence of the parenteral administration of the hepatotoxin on the function of carbohydrate metabolism of the liver. MASARU SHINMEN. *Japan. J. Exptl. Med.* 7, 67-85 (1928).—Hepatotoxins, prep'd. by immunizing rabbits with emulsions of rabbit and rat livers, were injected into rabbits and rats. Small doses had no effect on the blood-sugar level, on the degree of hyperglucemia produced by feeding glucose or by injection of adrenaline, or on the glycogen content of the liver. Successive large doses were toxic, and caused a marked loss of wt. A temporary hyperglucemia was produced, and a disturbed carbohydrate metabolism, persisting for several weeks. This was shown by a lowered tolerance to ingested glucose, a lessened degree of adrenaline hyperglucemia, and a marked decrease in the glycogen content of the liver. There was no indication of species specificity. ELEANOR M. HUMPHREYS

Pigmentation of the skin after treatment with irradiated ergosterol. J. BERNHEIM-KARRER AND G. ZARUSKI. *Monatsschr. Kinderheilk.* 42, 24-7(1929).—Irradiated ergosterol was administered to one of a pair of identical twins. Hyperpigmentation of the skin of the treated infant was observed. Comparison of microscopic sections of the skin of the treated and control infant showed a greater amt. of pigment in the basal layer of the epidermis of the former. Apparently, the oral administration of irradiated ergosterol has an effect on skin pigmentation similar to that induced by direct irradiation of the body surfaces. ELEANOR M. HUMPHREYS

A rare aniline poisoning in childhood. KURT OCHSENIUS. *Monatsschr. Kinderheilk.* 43, 54-7(1929).—"Pellidol," an acetyl deriv. of aminoazotoluene, is widely used in dermatological practice as an epithelial stimulant. A 2% salve was applied to the skin of an infant suffering from a severe eczema, with widespread excoriations. Marked cyanosis developed, and methemoglobin was demonstrated in the blood serum. Cyanosis disappeared upon removal of the dressings, and reappeared when the salve was again applied. ELEANOR M. HUMPHREYS

Idiosyncrasy towards irradiated ergosterol. KURT OCHSENIUS. *Monatsschr. Kinderheilk.* 43, 58-9(1929).—Irradiated ergosterol should not be used indiscriminately or in too large doses. Even in healthy infants it may give rise to gastrointestinal disturbances. ELEANOR M. HUMPHREYS

The action of synthetic thyroxine upon persons with thyroid hyperfunction. HANNS BAUR. *Deut. Arch. klin. Med.* 160, 212-32(1928); cf. *C. A.* 22, 3226.—Normal persons given 2 mg. thyroxine subcutaneously on 3 successive days showed a marked increase in the basal metabolic rate (10-30%) (persisted for 5-6 days). There was a slight increase in the pulse rate between the 3rd and 6th days, and slight discomfort. Persons with slight hyperthyroid symptoms, or with fully developed Basedow's disease, or with hyperthyroid function induced by I were not distinguished by their reaction to thyroxine. About $\frac{1}{4}$ of the cases showed an increase in basal metabolism; in $\frac{3}{4}$ the rate was only slightly or irregularly affected. Administration of I as diiodotyrosine or iodostearin caused the usual temporary decrease in metabolic rate. The effect of the thyroxine is not due merely to the I content. The effect of thyroxine or of I can be better judged by the pulse rate and by the general condition of the patient than by measurements of basal metabolism. P. Y. JACKSON

Origin and clinical behavior of acute lead poisoning. J. GELMAN. *Deut. Arch. klin. Med.* 163, 1-13(1929); cf. *C. A.* 22, 3930.—In numerous cases of acute Pb poisoning there was observed a considerable disturbance in pigment metabolism, accompanied by strongly marked hemolytic processes. Up to 4.2 mg. per liter coproporphyrin was excreted in the urine; there was a distinct increase in vital and basophilic granulation of erythrocytes, an increase of urobilin in the urine and of bilirubin in the blood. A

symptomatic and genetic relationship to acute genuine hematorporphyry is noted.

P. Y. JACKSON

Determination of the activity of cocaine-hydrochloride on different nerve trunks. J. REGNIER. *Compt. rend.* 189, 264-6(1929).—See C. A. 23, 4743. A. L.

The pharmacological action of mallein. A. M. PREOBRAZCHENSKŪ. *Z. Immunitts.* 58, 318-34(1928).—Mallein is, pharmacologically, of slight activity. The greatest sensitivity is shown by the cardio-vascular system for which it has a pressor action. JULIAN H. LEWIS

Lead in cancer treatment. SIMONE LABORDE. *Ann. méd.* 23, 411-8(1928).

A. E. MEYER

A pharmacologic and therapeutic research in some cases of diabetes. F. SERIO. *Minerva Med.* 9, 860-6(1929).—Report on the effect on blood sugar in the diabetic of adrenaline, histamine, thyroxine, pituitrin, atropine, ergotamine, pilocarpine, eserine, glukhormont, synthalin and acotin. A. E. MEYER

Studies on tissue respiration. V. The effect of thyroxine, adrenaline and insulin on the oxygen utilization of the surviving diaphragm of the rat. G. PAASCH AND H. REINWEIN. *Biochem. Z.* 211, 468-74(1929).—No effect was noted. S. M.

Clinical and experimental contributions to bismuth intoxication with special reference to stippling of erythrocytes. ERNST DERRA. *Folia Hematol.* 38, 367-78(1929).—Stippling of erythrocytes may occur in Bi poisoning but it is rare. J. T. M.

The phenomenon of oligodynamic action. Salt inhibition. N. LEITNER. *Zentr. Bakt. Parasitenk.*, I Abt., 112, 368-75(1929).—The oligodynamic action of Cu "activated" water was inhibited by NaCl concns. between $M/8$ and $M/32$, but not by higher or lower concns. Chlorides of K, Ca and Al gave similar curves. This cannot be explained by the formation of complex ions. JOHN T. MYERS

The sympathomimetic action of ephedrine. F. R. CURTIS. *J. Pharmacol.* 35, 333-41(1929). CECILIA RIEGEL

Antipyretic action and toxicity of combinations of magnesium with phenylcinchoninic acid. H. G. BARBOUR AND J. E. WINTER. *J. Pharmacol.* 35, 425-34(1929). C. R.

The effect of intravenous injections of colloidal lead upon the circulatory system. WALTER J. DILLING. *J. Pharmacol.* 35, 449-62(1929). CECILIA RIEGEL

Comparative investigations on the elimination of drugs administered intravenously or subcutaneously. LINA STRADA. *Arch. farmacol. sper.* 47, 36-55(1929).—The amts. of sodium hypophosphite and of sodium salicylate excreted by rabbits are approx. the same whether given intravenously or subcutaneously. Less KI is eliminated when given subcutaneously than when given intravenously. G. SCHWOCH

Toxicology of bismuth. II. Distribution of bismuth in the organism after injection of aqueous solutions of different bismuth compounds. R. FABRE AND M. PICON. *J. pharm. chim.* [8], 9, 97-112(1929); cf. C. A. 23, 2215, 3749.—Bi cacodylate (A) in aq. soln. and Bi camphocarbonate in oily soln. proved less toxic than ammoniacal Bi citrate (B) which caused death of the test animals in much weaker doses. In toxic doses, the kidneys are especially affected, and the urea content of the blood is increased. Then there is also an increase of Bi in hairs as eliminating organs. The liver retains a quantity of Bi varying with the rapidity of toxic development. The blood contains more Bi than in nontoxic cases, notably after the last injection before the Bi could become distributed. The brain absorbs more Bi on injection of oily than of aq. solns. A was rapidly eliminated and the quantities of Bi found were not high in any organ; the renal function was not much altered, and the urea content of the blood was not much increased unless a toxic dose was given. A final table summarizes the distribution of Bi in the various organs of the test animals used. S. WALDBOTT

Pharmacology of *Eriocoma floribunda*. G. G. COLIN. *J. Am. Pharm. Assoc.* 18, 876-80(1929).—This drug is not official in the Mexican pharmacopoeia. Weak infusions given to "help" labor often tetanize the uterine muscle. Alkaloids were absent. Partial pptn. with EtOH in an alk. medium, pH 9.5, gave an active fraction. This was sep'd. into an active and an inactive portion by partial soln. in H_2O . Cardiac and respiratory movements and blood pressure are not affected. There is no coagulating effect. The isolated uterus is contracted, the contractions being irregular and lasting 20 to 120 sec. with intervals of 20 sec. In this respect its action resembles pituitrin and ergot. The plant contains a large amt. of inert material so that fixing dosage is difficult. The active agent, which could not be isolated, has been named *ericomine*. L. E. WARREN

The action of non-specific irritants upon capillaries and the white blood picture in tuberculosis. REINHARD BRAUN. *Beitr. klin. Tuberk.* 69, 70-85(1928).—Following the parenteral introduction of min. amts. of non-sp. irritants (Aurophos, Lipatren, Ca

chlorate, nearsphenamine and ether ext. antibodies according to Jessen) no definite change in the capillaries examd. microscopically could be detd. In the majority of cases there was a constriction of the capillary loops a few minutes after the injection; this was the result of a reflex effect upon the vegetative nerve ends. After the use of Aurophos there occurred in the majority of cases an increase in the neutrophils, a diminution of the leucocytes and a shift of the leucocyte picture to the left. Ca called forth an eosinophilia.

H. J. CORPER

N-Phenyl- β -aminopropionamide-4-arsonic acid and related compounds [for trypanosomal infections] (HAMILTON, SIMPSON) 10.

I—ZOOLOGY

R. A. GORTNER

The influence of the thyroid gland and hypophysis upon growth and development of amphibian larvae. BENNET M. ALLEN. *Quart. J. Biol.* 4, 325-52(1929).—A review. J. B. BROWN

Chemical studies on the silkworm-pupa as fish food. I. The difference in chemical constitution of pupa of various sorts. OSHIMA-SHINOBU. *J. Imp. Fisheries Inst.* 23, 114-5(1929).—About 38 million kg. of dried silkworm-pupa is produced in Japan, most of which is used for fish food. It contains on the dry basis about 4.3% ash, 31% ether ext., 8.8% total N, 1% non-protein N. The protein of the Spring silkworm-pupa contains 14.82% total N, 1.05% amide N, 0.27% melanin N, 9.64% monoamino N, 3.85% diamino N, 0.87% histidine N, 1.05% lysine N, 1.88% arginine N and 0.05% cystine N. Among the sorts analyzed there were no large differences in proximate compn. or in N distribution. II. The digestion of silkworm-pupa with protease of eels. *Ibid* 115 6.—The protease of eels is most active between pH 5.7 and 7.4 at 33.5° to 36°. III. A chemical change of stored pupae. *Ibid* 117.—Wet pupae decompose in a few days. Dried pupae decompose slowly, the acid value of extd. oil increasing from 24.43 to 71.58 in a yr. D. B. DILL

The seasonal change of the chemical constitution of muscle of carps. OSHIMA-SHINOBU. *J. Imp. Fisheries Inst.* 23, 118-9(1929).—Carp in August contained 21.80% total solids, 1.21% crude ash, 2.30% ether ext. and 2.96% total N. Seasonal variations were not large. D. B. DILL

The chemical change of the eels in the course of fasting. OSHIMA-SHINOBU. *J. Imp. Fisheries Inst.* 23, 119-20(1929).—In 50 days' fast in water ranging from 8° to 18° total solids decreased from 42 to 40% and ether ext. from 24 to 21%. Loss of body wt. was about 11%. D. B. DILL

Glucolysis in the fertilized and non-fertilized eggs of sea urchins. RIVKA ASHBEL. *Boll. soc. ital. biol. sper.* 4, 492-3(1929).—After fecundation the eggs of sea urchin show a definite increase in anaerobic glucolysis. PETER MASUCCI

Blood-sugar studies on selachians. BRUNO KIRSCH. *Biochem. Z.* 211, 276-91 (1929).—It is considered that the normal blood-sugar level of these fish is about 20-40 mg. %, and this does not seem to depend upon the degree of filling of the gastrointestinal tract. In hepatectomized animals the blood-sugar level falls markedly in a few days, to 5-10 mg. %, the fall in sugar being much more rapid if the temp. is raised. Asphyxia causes hyperglucemia which at 15° appears in about an hr. and at higher temp. more quickly. Upon return to oxygenated water the blood-sugar level still continues to rise for a while and only very slowly comes back to the normal level. The extra sugar in the asphyxiated animals comes from the liver and does not occur in hepatectomized fish. Adrenaline causes marked asphyxia so that the rise and fall in blood sugar during asphyxia are associated with the response of the autonomic nervous system. S. MORGULIS

The content of reducing substances in the blood of some invertebrates. BRUNO KIRSCH. *Biochem. Z.* 211, 292-4(1929).—The blood of *Aplysia* shows only traces of reducing substance. In *Sipunculus*, *Carcinus* and *Eriphia* quantities are found similar to those noted in frogs or in sea fish. S. MORGULIS

Some physico-chemical phenomena during regeneration. III. Buffering of the tissues of the regenerating Axolotl limb. N. OKUNEV. *Biochem. Z.* 212, 1-15 (1929); cf. *C. A.* 23, 4274.—The tissue buffering of the regenerating Axolotl limb is definitely increased during the first 8 weeks of regeneration, and in addn. to the normally occurring buffering max. between pH 6 and 7, a second max. is observed also between pH 5 and 6. The tissue acidity in the first few days of regeneration is accompanied by a rise in buffer value which reaches its max. between the 5th and 8th regeneration day, at the time of a new rise in the tissue acidity, and then returns to normal. This

increase in buffering may either be due to an accumulation of acid cell decompn. products or to an increased adsorption of the tissues. S. MORGULIS

Influence of the ovary of normal and of laying hens on the growth and metamorphosis of frog tadpoles. GAETANO MOSCHINI. *Endokrinologie* 3, 29-32(1929).—Growth and metamorphosis of frog tadpoles are accelerated if fed on beef heart to which hen ovary had been added, either from normal or from laying hens, as compared to tadpoles fed on beef heart alone. Likewise tadpoles fed on meat from laying hens grow and metamorphose quicker than such fed meat from non-laying hens. S. M.

12—FOODS

F. C. BLANCK AND H. A. LEPPER

Food colors. L. WHINYATES. *Chemicals* 32, No. 11, 10-11(1929).—See C. A. 23, 3988. E. G. R. ARDAGH

Radium content of some foodstuffs. E. S. BURKSER, M. YA. SHAPIRO AND K. G. BRONSTEIN. *Biochem. Z.* 211, 323-5(1929).—With the exception of the ash from potatoes, a no. of foodstuffs studied showed a Ra content of 0.5 to 9.6×10^{-12} g. per g. of ash. S. MORGULIS

The damage to bread cereals by germination. Behavior of germinated meal in the baking process. M. P. NEUMANN, A. MÜHLHAUS AND H. KALNING. *Z. ges. Getriedewesen* 15, 24-35, 49-61; *Chem. Zentr.* 1928, II, 299.—The degree of germination of grains stored under moist conditions was estd. The rise in moisture content, decrease in carbohydrates, and change in protein and mineral form are characteristic. The condition of the meal or grain may best be estd. by detg. the diastatic power of the enzymes present by the method of Lintner. Germination up to 3% does not seriously impair quality but 5-10% seriously lessens the value of the meal or grain. In fermentation it is best to use a young but very active yeast. FRANCIS P. GRIFFITHS

Wheat and flour. FRANK T. SHUTT. Canada Dept. Agr., *Rept. Dominion Chemist, Year Ending March 31, 1928* 44-50(1929); cf. C. A. 23, 445.—Tables are given showing the protein, ash and H₂O content and av. wt. per 1000 kernels of the Marquis, Garnet and Reward varieties of wheat grown under various conditions in Alberta, Manitoba and Saskatchewan. In general, the Reward variety had the highest protein content and the Garnet variety the lowest. During the last 12 days of the ripening period there was a steady increase in the protein content of Marquis wheat. The bleaching agent Agene had no effect on either the amt. or character of the gluten in Marquis and Garnet flours, but treatment with Novaldelox B resulted in somewhat lower percentages of wet and dry gluten. K. D. JACOB

The colorimetric differentiation of rye and wheat flours and their mixtures. E. BERLINER AND J. KOOPMANN. *Z. ges. Mühlenwesen* 5, 42-5; *Chem. Zentr.* 1928, II, 501.—Wheat flour is dyed violet by concd. HCl while rye flour becomes red-brown. Mixts. give mixed colors. The violet color is due to a tryptophan reaction of the protein. Details of the test are given. C. R. FELLERS

Educational aspects of dairy and milk inspection. C. L. ROADHOUSE, et al. *Am. J. Pub. Health* 19, 1129-32(1929).—Rept. of the comm. of Internatl. Assoc. of Dairy and Milk Inspectors, 1928. J. A. KENNEDY

Metals for dairy machinery. Report to dairy research committee. F. H. McDOWALL. *New Zealand J. Sci. Tech.* 11, 14-25(1929).—Tinned Cu is used most for dairy app. As the Sn wears, Cu is in contact with milk or cream. Cu alloys like monel and silveroid are not substitutes for tinned Cu. Al is suitable for vats and tubes only if pure. Fabricated Al is better than cast. Al is too soft for cheese vats or milk cans, but expts. are being made with Al-Mn alloys. Al app. must not be cleaned with NaOH or Na₂CO₃, but by a Na₂CO₃-Na₂SiO₃ mixt. Ni can be used for milk app. It dissolves to some extent but does not affect taste. Experience with stainless steels has been variable, because of difference in manuf. Cr-Ni steels are satisfactory in all respects. E. M. SYMMES

Metals and their various influences on milk. OTTO F. HUNZIKER. *Proc. 8th World's Dairy Congress* 1928, 136-51.—See C. A. 23, 2506. A. PAPINEAU-COUTURE

Copper in dairy products and its solution under various conditions. II. J. MISCALL, G. W. CAVANAUGH AND P. P. CARODEMOS. *J. Dairy Sci.* 12, 379-84(1929).—A continuation of the investigation by Rice and Miscall (C. A. 17, 3211). The dissolving power of milk increases directly up to 140° to 145°F. and then decreases. It decreases by either removing the milk gases or adding CO₂. The presence of O increases the amt.

of Cu which goes into soln. but does not change the general type of the soly. curve as obtained in the other expts. Pasteurized milk dissolves more Cu than raw milk at the same temp. Conclusion: Some reaction takes place in the milk serum, when milk is heated for 2 hrs. in contact with bright Cu, above the temp. of pasteurization, which decreases the Cu-dissolving power of milk.

J. C. JURRIJENS

Bacteria that survive and grow during the pasteurization of milk and their relation to bacterial counts. PAUL S. PRICKETT AND ROBERT S. BREED. N. Y. State Agr. Expt. Sta., *Bull.* No. 571, 25 pp. (1929).

E. J. C.

A study of fungi found in milk. H. A. CUMMINS, VIOLET C. E. KENNELLY AND M. GRIMES. *Sci. Proc. Roy. Dublin Soc.* 19, 311-9 (1929).

E. J. C.

Methods of testing the cleanliness of milk in Germany. C. F. VAN OIJEN. *Proc. 8th World's Dairy Congress 1928*, 697-710.—A description of the principal phys., biochem., microscopical and bacteriological methods for testing the cleanliness of milk.

A. PAPINEAU-COUTURE

The judgment of milk from the hygienic point of view, with special reference to conditions in Denmark. S. ORLA-JENSEN. *Proc. 8th World's Dairy Congress 1928*, 656-60.—From a brief discussion of the problem, it is considered that the fermentation-reductase test should be combined with judgment by taste and smell in judging the quality of milk.

A. PAPINEAU-COUTURE

Control of the sanitary quality of market milk. ROBERT S. BREED. *Proc. 8th World's Dairy Congress 1928*, 666-70.—A brief outline of lab. methods used in North America for controlling the quality of milk: agar plate technic, methylene blue reduction method, direct microscopic examn.

A. PAPINEAU-COUTURE

Modern methods of laboratory control for milk supply. MOHR. *Proc. 8th World's Dairy Congress 1928*, 673-89.—A description of the control of the quality of milk supply, as exemplified by the tests in use at Meierei C. Bolle A. G., Berlin, and the School Dairy of the Prussian Dairy Exptl. and Research Inst., Kiel, the methods being described and interpretation of the results discussed.

A. PAPINEAU-COUTURE

The freezing point of milk. J. D. FILIPPO. *Proc. 8th World's Dairy Congress 1928*, 723-5.—Detn. of the f. p. of milk has been used for the last 20 yrs. in Holland for the detection of added water in milk, a f. p. higher than -0.53° being considered evidence of watering. Of thousands of milks of known purity there was found but one with an abnormal f. p., viz., -0.48° to -0.51° , in a herd of 20 cows belonging to 1 farmer; in this case the feed of the cows had been insufficient for several months, and contained a large quantity of water. The precautions which should be taken in carrying out the detn. are briefly outlined.

A. PAPINEAU-COUTURE

The freezing point of milk as a means of detecting added water. J. H. BUCHANAN AND O. E. LOWMAN. *Proc. 8th World's Dairy Congress 1928*, 725-33.—In general the depression of the f. p. of milk, as suggested by Hortvet, is a satisfactory method for detecting added water. H_2O contg. either electrolytes or nonelectrolytes may be added in appreciable quantities without the depression of the f. p. being affected by these substances. There is a variation in depression of the f. p. depending on the season, high values being found in April and May and low values in Dec. and Jan.

A. P.-C.

The effect of heat on milk. (A) The coagulability by rennet. (B) The nitrogen, phosphorus and calcium content. ELFREDA C. V. MATTICK AND HOWARD S. HALLETT. *J. Agr. Sci.* 19, 452-62 (1929).—Milk which has been heated to temps. varying from 105° to $209^{\circ}F.$ for $\frac{1}{2}$ hr. differs from raw milk in its reaction to rennet in all cases. There is a pronounced "slowing down" in coagulation, becoming more marked with the higher temps. There is no change in the diffusibility of the nitrogenous substances, after heating to 105 – $209^{\circ}F.$ for $\frac{1}{2}$ hr. Heating to $175^{\circ}F.$ and above for $\frac{1}{2}$ hr. appears to reduce the diffusibility of the P content. Heating to $125^{\circ}F.$ and above for $\frac{1}{2}$ hr. causes marked diminution in the Ca content.

P. R. DAWSON

A study of the apparent viscosity of milk as influenced by some physical factors. GEORGE M. BATERMAN AND PAUL F. SHARP. *J. Agr. Research* 36, 647-74 (1928).—The viscosity coeff. of whole milk, condensed skim milk and even skim milk is not independent of the rate of shear but decreases as the rate of shear is increased, approaching a const. value at high rates of shear. Mech. agitation produces no decrease in the viscosity of skim milk or of homogenized milk but it may cause a decrease in the viscosity of milk contg. clumps of fat globules on account of the breaking up of the clumps. The viscosity of skim milk increases with age. Homogenization causes a distinct rise in the viscosity of whole milk but produces no change in the viscosity of skim milk. Pasteurization of skim milk at 62° for 30 min. causes a slight increase in viscosity when detd. at 25° , and maintaining skim milk in a frozen condition for 1 day has a similar effect. The viscosity values obtained after dilg. skim milk with various amts. of water fall on a slight curve

showing that the viscosity is not strictly a linear function of the total solids. The expts. indicate that the viscosity of a sample of milk does not accurately indicate the total solids content except possibly for very restricted groups of samples. W. H. ROSS

Factors affecting the yield and quality of milk. I. The age of the cow. R. R. KAY AND ANDREW C. M'CANDLISH. *J. Agr. Sci.* 19, 342-72(1929). The variations in production due to age were investigated with the records of 738 Ayrshire cows for 4380 lactations. Milk and butterfat production increase up to about 7 yrs. of age and then decrease. The fat % is higher for 3-yr. olds than for older cows. After 3 yrs. there is little change in the fat % with age that is of practical significance until advanced ages are reached, when there may be an important drop. The tendency for milk to show a slightly lower fat % as the cow advances in age is probably due to the fact that as the milk yield changes the fat yield changes in the same direction but at a slower rate. Heifers with a low fat % need not, as a rule, be expected to test higher on reaching maturity. P. R. DAWSON

The influence of feeding on the composition of milk. Mangels versus dried sugar beet pulp. HAROLD T. CRANFIELD. *J. Agr. Sci.* 19, 302-10(1929).—Expts. were carried out with 2 groups of cows at each of 2 centers in Leicestershire during the spring of 1928, to compare the values of mangels and dried sugar beet pulp in the winter ration of dairy cows. Composite samples of the milk from each group of cows were taken at 6 consecutive milkings per week during the period of the expt. Detns. of fat and solids-not-fat were made, and the yield of milk at each milking was recorded. Although there are indications that the change of ration caused a slight temporary variation in the quality of the milk, the secretion of milk solids followed, generally, the variation in yield. This is confirmed by the av. compn. figures representing the whole of the milk from each particular ration. P. R. DAWSON

Variation in the composition of the milk of an abnormal cow. H. T. CRANFIELD AND E. R. LING. *J. Agr. Sci.* 19, 491-9(1929).—Studies were made of the compn. of the milk during a period covering 3 lactations of an abnormal cow, subsequently found to be suffering from tuberculosis of the udder. The percentages of fat were very variable but the solids-not-fat were consistently low, only 2% of the total no. of samples exceeding 8.5%. Protein and lactose were much below the av. for normal milk. With total ash the figures were normal. Of the ash constituents, the insol. portion was low and the sol. portion very high, indicating a high Cl content. The percentages of P_2O_5 and CaO were considerably below the av. for normal milk. The lactose and sol. ash percentages showed a marked neg. correlation, supporting the contention that a definite lactose-Cl ratio exists in milk. It is suggested that an abnormally low solids-not-fat content and abnormal percentages of the individual ash constituents may be a sign of incipient disease affecting the milk-secreting organs. P. R. DAWSON

A practical method for fat determination in milk. BALWANT SINGH. *J. Central Bureau Animal Husbandry & Dairying India* 2, 178-9(1929).—To 11 cc. of milk contained in a Gerber tube, add 5 cc. Fehling soln. (50-55 g. NaOH, depending on quality, and 173 g. Rochelle salt in 500 cc. H_2O) and 1 cc. of a mixt. of 55 parts isobutyl alc. and 45 parts MeOH. Invert the tube, shake gently, and immerse in a water bath at 80° until the color of the liquid becomes deep orange (about 3 min.). Remove the tube, shake as before and heat 3 min. longer. Add 5 cc. of hot water, disturbing the fat layer as little as possible, and invert the tightly corked tube in the water bath for a short time until the column of fat becomes distinct and easily readable. The method is rapid and accurate and requires no particular skill for its operation. Figures comparing results by this and other methods are not given. K. D. JACOB

The direct and indirect determination of the energy power of milk in relation to the nutritive needs of the child. ELIA SAVINI AND ORESTE GARZIA. *Proc. 8th World's Dairy Congress* 1928, 543-8.—Many samples of milk were analyzed for fat, protein and lactose, and the calorific values were calcd. from these results by means of various formulas and were also detd. directly in a Mahler bomb calorimeter. Indirect detn. by means of formulas based on the fat content is eminently suitable for estg. the nutritive requirement of the child, as the values thus obtained do not differ from that detd. directly by more than $\pm 20-30$ cal. for collected milks of normal compn., by more than ± 60 cal. in milks contg. 4-4.5% fat, and by more than 100 cal. in cases of exceptional fat content (above 4.7%), and also because the calorific value is obtained more rapidly and with less chance of error by the indirect than by the direct method. Among the formulas studied, the following modification of Andersen's formula gave the most approx. correct results: $C = 280 + 113.5 \times G$, in which C is the calorific value of 1 kg. of milk and G the % fat. The use of the calorific power of milk, found indirectly, greatly facilitates the prepn. of a milk of known energy power, even for market milks. A. PAPINEAU-COUTURE

The solubility of calcium phosphate in fresh milk. E. O. WHITTIER. *J. Dairy Sci.* 12, 405-9(1929).—A calcn. has been made of the Ca-ion concn. of normal fresh milk, based on recent exptl. results bearing on the mutual effects of H, Ca, P and citrate ions on one another. A calcn. of the ion product $[Ca^{++}] \times [HPO_4^{--}]$ in normal fresh milk gives a value less than that of the corresponding soly. product. Exptl. evidence as to the validity of the method of calcn. is offered in the form of an expt. in which the pptn. of Ca phosphate was prevented by the presence of citrate. Conclusion: The soly. of Ca phosphate in milk is affected by the amt. of citrates present and this effect is probably specific. J. C. JURRJEHS

The ash and non-fatty solids content, the specific gravity and the determination of the refractive index of the calcium chloride serum in individual samples of milk. L. BÉM. *Proc. 8th World's Dairy Congress 1928*, 767-8.—The n of the CaCl₂ serum of the milk was detd. 3 hrs. after milking, and again 12-18 hrs. later; at the time of the 1st n detns., the sp. gr. of the milk and of the serum, total solids, fat and ash were also detd. No strict rule was found relating the n to the other figures. On the 72 samples examd., there was an av. increase of 0.5° (Zeiss immersion refractometer) in the n after 12-18 hrs., in 6 cases the increase was 1.05-2.45° and in 14 it was 0.55-0.9°. With very few exceptions the ash of the morning milk was greater than that of the evening or that of the midday milk, while the sp. gr., n and solids-not-fat were smaller in the morning milk.

A. PAPINEAU-COUTURE

Appreciation of the refractometer test. JOHN HANLEY. *Proc. 8th World's Dairy Congress 1928*, 744-67.—An extensive discussion of the value of the refraction of the milk serum for detecting added water. H. agrees with Tocher that the f. p. of milk is its most const. property and that the n is 2nd in this respect. A. PAPINEAU-COUTURE

The value of the refractometer in milk analysis. G. D. ELDON AND J. R. STUBBS. *Proc. 8th World's Dairy Congress 1928*, 740-3; cf. C. A. 22, 1632.—From a consideration of the literature and from their own examn. of over 7000 samples of mixed milks, E. and S. think that the refractometric test for the detection of added water offers no advantage over the detn. of the solids-not-fat. In one respect it is definitely inferior, since as decompn. proceeds the amt. of solids-not-fat found is always lower than that for the fresh milk, while the refraction figure first rises above that of the fresh milk and then falls below it. The test therefore is of value only when the milk is fresh. E. and S. cannot accept the statement that a milk naturally deficient in solids-not-fat gives a normal refraction, as such samples are entirely outside their experience and are quite at variance with the general conclusions to which exptl. data point. A. P.-C.

Study of the use of the methylene-blue (reductase) test in the grading of milk. M. GRIMES. *Proc. 8th World's Dairy Congress 1928*, 713-6; cf. C. A. 22, 120.—Results are compared of the reductase test (using 40 cc. of milk) and bacterial counts (incubating either 48 hrs. at 37° or 120 hrs. at 20°) on 867 samples of milk that had not been cooled or treated in any way and most of which were examd. 3-8 hrs. after milking. The test was found unreliable for the grading of milk with low bacterial count. Where milk is cooled and held at low temps. for over 24 hrs and the reductase time compared with the total bacterial count, the latter will often be markedly in excess of the max. bacterial count given in the various grades. The test is of greatest value in grading milk supplies when combined with the fermentation test.

A. PAPINEAU-COUTURE

Comparison of the bromothymol blue milk test and the methylene blue reaction test for determining quality of milk. F. D. DEVEREUX. *J. Dairy Sci.* 12, 367-73 (1929).—The bromothymol blue test fulfils its purpose, grading milk fairly accurately into a large no. of classes according to keeping quality, when av. scores were studied. The reduction test fluctuated more, but was able to grade milk into 4 classes with equal accuracy. The correlation coeffs. between each test and the keeping quality were both found to be +0.77.

J. C. JURRJEHS

Progress in the irradiation (of milk) by ultra-violet light. A. SALMONY. *Chimie & Industrie* 22, 259-60(1929).—The 2 chief difficulties preventing the irradiation of milk are the production of O₂ and the heating of the milk. These have been overcome by operating in an atm. of CO₂ and providing a suitable cooling element. A commercial app. (briefly described) has been constructed and is operating successfully. A. P.-C.

Some of the physical and chemical properties of powdered milk. A. MIYAWAKI. *Proc. 8th World's Dairy Congress 1928*, 370-6.—A summary of the studies on the subject made at the Hokkaido Imperial Univ., Japan. A. PAPINEAU-COUTURE

The action of viscogen (calcium saccharate) on milk and cream. G. T. PYNNE. *J. Agr. Sci.* 19, 463-71(1929).—Investigations showed that the primary reaction appears to be the formation of a ppt. of insol. (tri-Ca) phosphate. Considerable quantities of casein are carried down by the ppt., and this co-pptn. of casein is probably the single

factor which most influences the viscosity. Casein is not directly pptd. by viscogen, but the viscosity of its solns. is slightly increased as a result of their higher alkyl, on account of this reagent. This action of viscogen is relatively unimportant in influencing the viscosity of milk or cream. P. R. DAWSON

Some factors influencing viscosity in cream. G. T. PYNE and J. LYONS. *Proc. 8th World's Dairy Congress 1928*, 184-8; cf. *C. A. 22*, 2999.—Pasteurization reduces considerably the viscosity of cream. This can be restored in a large measure by quickly chilling the pasteurized cream and almost immediately re-sepg. at a low temp. (50°F.). A considerable amt. of fat passes away in the "skim" milk from the re-sepn., but can be returned to the new milk or cream vats and need not occasion any loss. Gradual addn. of lactic acid to pasteurized cream produced marked increases in viscosity in rich cream (50% fat) at lower serum acidities than with poorer creams, the increase becoming noticeable at a p_H value varying from about 5.8 to 5.0 according to the richness of the cream and the method of adding the acid. When the acidity is developed by inoculation with a culture of *Streptococcus lactis* the "critical acidity" of the serum is the same for both rich and poor creams, has a higher value than that found by direct addn. of lactic acid and occurs fairly sharply around p_H 4.8-4.9. Examn. of the dild. creams showed visible flocculation in all cases where viscosity was greatly increased, irrespective of the exact degree of acidity at which it took place. A. PAPINEAU-COUTURE

The lipolysis of worked butter, several days after preparation. OTTO GRATZ. *Proc. 8th World's Dairy Congress 1928*, 456-60.—Lipolysis was not appreciably influenced during the 1st 14 days through the mixing of the outer with the inner part, but after that considerably greater lipolysis took place in the butter which had been reworked without removal of the outer layer; but the length of time that elapsed between the making of the butter and the re-working had no particular influence on the degree of lipolysis that took place. The expts. were carried out at room temp., while in com. practice it is generally stored at about 1-2°; similar conditions probably would have been found if the butter had been subjected to low-temp. tests, but would have taken longer to develop. A. PAPINEAU-COUTURE

Adulteration of butter and ghee with animal fat and vegetable ghee and its detection. PHANIBHUSAN SANYAL. *Mem. Dept. Agr. India, Chem. Ser.* 10, 143-55(1929); cf. HARRISON, *C. A.* 23, 4519. K. D. JACOB

A study of lactose-fermenting yeasts isolated from milk, cream and butter. M. GRIMES and J. DOHERTY. *Sci. Proc. Roy. Dublin Soc.* 19, 261-4(1929). E. J. C.

The microbial flora of belpaese (cheese). G. DALLA TORRE. *Proc. 8th World's Dairy Congress 1928*, 462-3.—Fresh belpaese (Galbani) contained lactic acid bacteria, particularly *Streptococcus lactis* in large numbers, together with smaller numbers of lacto bacilli (the thermobacterium and streptobacterium of Jensen) and also yeasts and bacteria of the coli-aerogenes groups to a less extent. The microflora of the ripe cheese does not vary greatly from that of the raw curd. A. PAPINEAU-COUTURE

A color defect of process cheese. WALTER V. PRICE. *J. Dairy Sci.* 12, 377-8 (1929).—The normal color usually darkened during the last stages of the heating process. It was found to be due to an accumulation of residual cheese caused by the stopping of the process during the noon hour recess. Cleaning the kettles after each batch made removed the defect. J. C. JURRJENS

The casein-splitting properties of starters. C. BARTHEL and W. SADLER. *Proc. 8th World's Dairy Congress 1928*, 654-6; cf. *C. A.* 23, 1695.—Cultures of isolated lactic acid bacteria of the *Streptococcus* group often produce the same amt. of "sol. N" from casein as do the starters, but the amt. of amino N produced in the pure cultures is far below the amt. of amino N produced by the mixed cultures in the form of starters. The importance of the casein-splitting properties of the lactic acid bacteria of the *Streptococcus* group, with respect to the explanation of the process of cheese ripening, is emphasized by the fact that ordinary starters as used in the manuf. of cheese possess the power of forming large quantities of amino acids from casein. A. PAPINEAU-COUTURE

Relation of temperature of fermentation to quality of sauerkraut. E. A. MARTIN, W. H. PETERSON, E. B. FRED and W. E. VAUGHN. *J. Agr. Research* 39, 285-92(1929).—The quality of sauerkraut depends very largely upon the temp. at which fermentation is carried out, the most favorable temp. for fermentation being between 60° and 65°F. High temps. favor the production of soft and pink sauerkraut. A rise or 3° to 5°F. occurs during the first 8 days in fermentation vats kept at temps. above that of the surrounding air. This rise in temp. is coincident with the greatest activity of the bacteria and is believed to be due to bacterial action. W. H. ROSS

The respiration factor in the deterioration of fresh vegetables at room temperature. MARJORIE P. BENOY. *J. Agr. Research* 39, 75-80(1929).—Numerous green vegetables

of edible maturity were subjected to comparative examn. during the first 30 hrs. after they were harvested. Their changing rates of respiration at 30° were measured and plotted, the total amt. of CO_2 evolved between the 2nd and the 26th hrs. was calcd., and the wts. of glucose presumably oxidized in producing this quantity of CO_2 were computed. With respect to the amt. of gas evolved for equal wts. of dry matter during the 24-hr. period, the vegetables stand in the following descending order: asparagus, lettuce, green bean, okra, green onion, carrot, tomato, beet and green mango. The amts. of glucose accounted for vary from 13.682 g. per 100 g. of dry wt. in 24 hrs. for asparagus to 1.962 g. for green mango. W. H. ROSS

Limes and wither-tip. R. O. WILLIAMS. *Trop. Agr.* (Trinidad) 6, 187-91(1929).—Chem. data are given relating to new varieties of limes. The fruit of a variety found to be resistant to wither-tip disease contained 5.2% citric acid. The expressed oil contained less than half the normal amt. of citral. The sp. gr. and refractive index were also below the lower limit of normal oils. A. L. MEHRING

Composition of commercial acid lead arsenate and its relation to arsenical injury. H. S. SWINGLE. *J. Agr. Research* 39, 393-401(1929).—At low concns. of equiv. As content H_2AsO_3 and H_2AsO_4 are equally toxic to peach foliage but at higher concns. the latter is the more toxic. Arsenic acts as a cumulative poison within peach leaves. The min. concn. of H_2AsO_4 toxic to peach foliage contains the equiv. of 0.0012% of As_2O_3 . Acid lead arsenates contg. less than 0.25% of As_2O_3 in water-sol. form give min. foliage injury and there is, therefore, no advantage in making further reductions in sol. As. PbHAsO_4 cannot be safely used upon susceptible plants without the addn. of some material to prevent burning. The initial sol. As, within ordinary limits, has little or no effect upon the toxicity of PbHAsO_4 to insects. W. H. ROSS

Sulfur-spray residues and the swelling of tin cans packed with peaches. C. W. CULPEPPER AND H. H. MOON. *J. Agr. Research* 39, 31-40(1929).—S-spray residues on the surface of peaches used in canning cause the formation of H_2S and H with the subsequent swelling of the can. Almost all forms of S in the acid juices of the peach lead to the same result. The S has also a corroding effect on the can and seems to act as a catalytic agent in greatly accelerating the action of the fruit acids upon the metal of the container. Certain forms of S corrode the can even when no org. acids are present, but no swelling occurs in the absence of these acids. In ordinary canning the acid juices of the peach act as an electrolyte in which Fe is cathodic to Sn when they are in contact, but if H_2S is present the ferric salts are reduced to the ferrous form and Fe may become anodic to Sn. This relationship, together with the fact that H_2S accelerates the liberation of H from Fe, seems to account for the swelling of cans packed with peaches. S-spray residues may be effectively removed from the surface of peaches by dipping the fruit in hot dil. lye for a few sec. and then washing the fruit with jets of cold water. W. H. R.

Occurrence of the tetanus bacillus in canned peas. F. MARSH AND J. HENDERSON. *Analyst* 54, 536-7(1929).—Many cans of peas imported from Persia during the hot season were "blown" and the contents had a putrid odor. The cans were attacked to a considerable extent and contained gases which were essentially CO_2 and N_2 in approx. equal parts. Bacteriol. examn. showed the presence of *B. subtilis*, *B. mycoides* and *B. tetani*. W. T. H.

Studies on chestnut molds. F. BERTOTTI. *Boll. lab. sper. fitopatol.* (Turin) 6, No. 3, 6-8(1929).—Dusting treatments with Na benzoate, Fe sulfate and salicylic acid are useless with *Penicillium crustaceum*. In this case treatments of the molded chestnuts with didd. HCl or H_2SO_4 without subsequent drying are necessary. G. A. BRAVO

Forage crops. FRANK T. SHUTT. Canada Dept. Agr., *Rept. Dominion Chemist, Year Ending March 31, 1928*, 59-67(1929).—Tables are given showing the chem. compn. of grasses and clovers from Nova Scotia, and hays from the dyked lands of Nova Scotia and New Brunswick and 20 varieties of western prairie forage plants cut at various stages of growth. The high content of protein and ash and low content of fiber in a sample of Russian thistle (*Salsola pestifer*), cut at the early flowering stage, indicated that this plant may prove to be of considerable value for stock feeding. K. D. JACOB

Feeding stuffs. FRANK T. SHUTT. Canada Dept. Agr., *Rept. Dominion Chemists, Year Ending March 31, 1928*, 71-8(1929).—Tables are given showing the compn. of com. and miscellaneous feeding stuffs from Canadian sources. K. D. JACOB

Nutritive value of pasture. IV. The influence of the intensity of grazing on the yield, composition and nutritive value of pasture herbage. II. H. E. WOODMAN, D. B. NORMAN AND J. W. BEE. *J. Agr. Sci.* 19, 236-65(1929); cf. C. A. 22, 2219.—As compared with grass grown under a system of weekly and 2-weekly cuttings, grass cut every 3 weeks showed a slight lowering of the % of crude protein and a slight increase in the % of crude fiber and N-free extractives. There was little difference in the ether ext.,

SiO₂-free ash, Ca and P₂O₅. The main results relating to seasonal variations in the chem. compn. of the 3-weekly pasture cuts were in harmony with those obtained in the 1925 and 1927 investigations. The depressing effect of drought on the crude protein content of grass appears to be more pronounced with weekly cuttings than with 3-weekly. The different intervals of cutting had little effect on digestibility of the grass. At the end of a 3-weeks' period of growth pasture grass still retains the non-lignified highly digestible character possessed at the end of 1 or 2 weeks; and, while slightly less rich in digestible protein, is equal in respect to total digestible org. matter and starch equiv. Cutting at fortnightly intervals produced 29.3% more dry matter over the whole season than did weekly cuttings; the yield from 3-weekly cuttings was 62.3% greater than that from weekly and 25.5% greater than that from 2-weekly cuttings. P. R. DAWSON

Studies of the composition, digestibility and feeding value of linseed cake and extracted linseed meal. F. HONCAMP, P. MALKOMESIUŠ AND A. PETERMANN. *Z. Tierzucht. Zuchtungsbiol. Tierernähr.* 15, 277-88(1929).—In feedings trials with dairy cows linseed cake and extd. linseed meal proved of substantially equal value as detd. by the quantity and fat content of the milk produced. The 2 products were included in rations which were kept identical as regards intake of digestible protein and starch value per 1000 kg. live weight. The 2 products were substantially alike as regards digestibility. L. A. MAYNARD

Grain losses in feeding corn silage to dairy cows. R. B. BECKER AND WILLIS D. GALLUP. *J. Agr. Research* 39, 223-7(1929).—Corn kernels lose protein, crude fiber and ash in the silo but gain in percentages of N-free ext. and ether ext. When dairy cows were fed silage made from dent corn in the glazed stage of maturity, 8.47% by wt. of the grain in the silage was voided in the manure and only 4.36% by wt. of the whole kernels in the silage was recovered as whole kernels from the manure. Analyses showed slight losses of protein, ether ext. and ash from the corn grain in silage which passed through the cow's digestive tract. The corn grain voided in the manure was calcd. to contain 5.22% of the digestible crude protein and 5.26% of the total digestible nutrients in the corn silage. The loss of whole corn in silage fed to dairy cows is decidedly less than that which occurs when cattle consume shelled corn. W. H. ROSS

Pb in red glaze [of culinary ware] (GRONOVER, WOHLNICH) 19. Particle size and the properties of matter [in manufacture of baking powder] (NEVILLE) 2. Endemic goiter and its relation to I content of food (HAYNE) 11G. The mean and variability as affected by continuous selection for composition in corn (WINTER) 11D. Denatured raw sugar as fodder (KRAUS) 28. The individuality of the mammary glands of the cow (PROKS) 11F. The tomato stalk and its value as a fodder (GUARNIERI) 11D. The relation between some constituents of fruit juice and the keeping quality of the fruit at low temperature (LEONCINI, LEVI) 11D. Quantitative examination of the Kreis rancidity reaction (PRITZKER, JUNGKUNZ) 27. Saponification value of fats (TAUFEL, RUSCH) 27. Animal feeding and brewery by-products (HEIGHAM) 16. The chemistry of pectins from fruit (EHRlich, KOSMAHL) 10. Apparatus for sterilizing milk or other liquids by electric treatment (U. S. pat. 1,730,016) 1.

Frozen egg-yolk material. ALBERT K. EPSTEIN (to Emulsol Corp.). U. S. 1,730,879, Oct. 8. An edible salt such as NaCl, Na₂HPO₄ or other substantially neutral edible salt is added to egg yolk (2-8% of NaCl being suitable) and the mixt. after freezing and thawing has a viscosity greater than that of the untreated, unfrozen yolk and a mobility greater than that of untreated yolks when thawed after freezing.

Preserving fresh fruit. SAMUEL E. OLIVER. U. S. 1,729,893, Oct. 1. The temp. of fruit is reduced to about 1° and the temp. of sugar is reduced to about -1° and the fruit and sugar are then packed in a container in such a manner as to isolate the individual fruit from each other and from the container walls, while the temp. is maintained, and the container is then sealed.

13—GENERAL INDUSTRIAL CHEMISTRY

HARLAN S. MINER

The Battelle Memorial Institute. H. W. GILLET. *Mining Met.* 10, 472-4(1929).

The Leipzig Autumn Fair. HEINRICH WIESENTHAL. *Chem.-Ztg.* 53, 691-2 (1929).—The products of "Frigidaire," "Kelvinator," and titanium white are singled out as worthy of special notice. E. J. C. W. C. BRAUGH

The use of power in chemical industries. C. M. A. STINE. *Chem. Age* (London) 21, 237; *Natl. Eng.* 33, 273-4(1929).—"The chem. engineer must have an increasing part in the efficient utilization of the resources of fuels. He is interested in the methods of production of the power as well as in the ultimate costs of the finished power."

W. H. BOYNTON
Acid-resisting products for chemical plant. REX FURNACE. *Chem. Age* (London) 21, 190-3(1929).—The wide range of acid-resisting materials available to chem. engineering today, due to the advance in metallurgy, is reviewed.
E. M. SYMMES

Manipulation in intensive drying. HERBERT B. BAKER. *J. Chem. Soc.* 1929, 1661-4.—The kind of glass suitable for drying expts. and its cleaning are discussed. Drying app., lubricants and purity of materials are reviewed.
S. LENHER

Notes on intensive drying of gaseous media. WM. A. BONE. *J. Chem. Soc.* 1929, 1664-6.—A review of B.'s work.
S. LENHER

The drying of solids. II. T. K. SHERWOOD. *Ind. Eng. Chem.* 21, 976-80(1929).—The third case in the drying of a solid referred to in an earlier article (cf. *C. A.* 23, 1451) is non-existent. All wet solids dried under const. conditions exhibit a period of const. rate of drying, followed by one of falling rate. During the former the drying is like the evapn. of H_2O from a free liquid surface; the effect of adjoining dry surfaces, of radiation from surroundings and of air velocity upon the drying are presented by equations and graphs. The falling rate period is divisible into 2 zones: (a) following the crit. point, characterized usually by a linear relation between the rate of drying and H_2O content, and (b) marked by a curve concave upward when the rate of drying is plotted vs. H_2O content. In the former the rate of drying decreases because of a decrease in the wetted surface, and in the latter, internal liquid diffusion controls the drying. An empirical equation is proposed which serves as a basis of calcs. in drier design, and its use illustrated.
W. C. EBAUGH

Vaporization of complex mixtures. WALTER J. PODBIELNIAK AND GEO. G. BROWN. *Ind. Eng. Chem.* 21, 773-9(1929).—Fundamental equations applicable to the continuous and differential vaporization processes were derived and checked by comparison with exptl. data. A sample of natural gasolines was used in this investigation. The two different processes were studied experimentally and theoretically and 9 specific conclusions were reached.
E. S. WALLIS

The recovery of volatile vapors and gases by means of active carbon. W. KARSTEN. *Teer u. Bitumen* 27, 445(1929).—A discussion of the well-known principles of charcoal absorption of gases.
W. H. STABNER

Heat transfer by condensation in saturated and superheated steam. M. JAKOB AND S. ERK. *Z. Ver. deut. Ing.* 73, 761-2(1929).—Exptl. results are given on heat transfer through the walls of a vertical tube externally cooled. Superheated or satd. steam was used; it passes through the tube. Results show that heat transfer decreases with increasing wall temp., and increases with increasing steam flow. In general, the heat transfer from superheated steam was greater than that from satd. steam. Results agree with values deduced from Nusselt's theory of surface condensation.
C. Z. ROSECRANS

Flow resistance of gas-oil mixtures through vertical pipes. L. C. UREN, P. P. GREGORY, R. A. HANCOCK AND G. V. FESKOV. *Am. Inst. Mining Met. Eng., Tech. Pub.* No. 252, 13 pp.(1929).
E. J. C.

Cleaning air by the adhesive impingement method. J. H. MILLIKEN. *Iron Steel Eng.* 6, 521-5(1929).
W. H. BOYNTON

Refrigerating characteristics of carbon dioxide. W. R. WOOLRICH. *Power Plant Eng.* 33, 1021-4(1929).—Although presenting many mech. disadvantages in prepn., CO_2 has many unusual characteristics. It is odorless and can be shipped and used in solid, compressed form. Its property of self-insulation greatly increases its heat absorbing properties. Many data are included.
D. K. FRENCH

Sulfur dioxide. Its characteristics as a refrigerant. W. R. WOOLRICH. *Power Plant Eng.* 33, 805-8(1929).— SO_2 is considered applicable to small refrigerating units. Comprehensive charts and much data are included.
D. K. FRENCH

Low-humidity drying (TOMLINSON) 2. Some radiation heat transfer formulas (SAUNDERS) 2. Heat transfer: a liquid flowing through a porous prism (SCHUMANN) 2.

System of partial liquefaction for separating hydrogen from gaseous mixtures such as coke-oven gas. GEORGES CLAUDE (to Soc. l'air liquide, Soc. anon. pour l'étude et l'exploitation des procédés Georges Claude). U. S. 1,730,806, Oct. 8. An app. and various details of procedure are described.

Refrigerating system utilizing mixed crushed ice and water. CROSBY FIELD (to Flakice Corp.). U. S. 1,730,922, Oct. 8. An app. is described.

Refrigerating apparatus of the absorption type. CARL G. MUNTERTS (to Electrolux Servel Corp.). U. S. 1,729,625, Oct. 1. Structural features.

Refrigerating apparatus of the compression type. CARL P. BROCKWAY (to Industrial Research Corp.). U. S. 1,730,116, Oct. 1. Structural features.

Refrigerating apparatus of the compression type. IVAR LUNDGAARD (to Devon Mfg. Co.). U. S. 1,730,580, Oct. 8. Structural features.

Waterproof wrapping cloth. CHARLES H. PANTHEN (to General Electric Co.). U. S. 1,729,681, Oct. 1. Fabric such as strong open weave cloth is rendered suitable for wrapping elec. machinery by impregnation with a mixt. of soft adhesive pitch with about 7% its quantity of mineral oil adapted to prevent hardening of the pitch.

Insulating filament. HENRY A. GARDNER. U. S. 1,730,417, Oct. 8. Artificial cellulosic filaments suitable for use as an insulation similar to silk are prep'd. contg. an elec. non-conductive resin such as a phenol-CH₂O synthetic resin and a finely divided non-conductive micaceous substance in sufficient quantities to produce an elec. non-conductive effect.

14—WATER, SEWAGE AND SANITATION

EDWARD BARTOW

Water resources activities in North Carolina. CHARLES E. RAY, JR. *J. Am. Water Works Assocn.* 21, 1196-1205(1929). D. K. FRENCH

Manganese in the water supplies of New Jersey. LEROY FORMAN. *J. Am. Water Works Assocn.* 21, 1212-7(1929).—Mn affected the *o*-tolidine test for Cl and made it unreliable, 0.1 p. p. m. Mn in manganic form gave a color corresponding to 0.13 p. p. m. residual Cl. A method is outlined which should easily and accurately det. 0.02 p. p. m. Mn in water. D. K. FRENCH

London water supply. ALEXANDER HOUSTON. *Twenty-third Ann. Rept., Water Works and Sewerage* 76, 371-2(1929).—Chlorination of the Thames water has reduced the amt. of necessary pumping to reservoirs and increased the amt. of water filtered per acre of beds cleaned. The prefiltration waters which include raw, stored and gravel water are improved from 100 to 1000 times when compared on the basis of *B. coli* content with the raw river water. Double filtration, that is, filtration through primary roughing filters at high rates followed by filtration either through slow or rapid sand filters at rates higher than customary, has been very successful. C. C. RUCHHOPL

Physicochemical determinations on the potable waters of Milan. FILIPPO PRATO PREVIDE. *Giorn. chim. ind. applicata* 11, 265-6(1929).—The cond. and f. ps. of all the potable waters supplying Milan were measured, and the insol. residues of the waters calcd. from these data. The residues were also detd. chemically. The 2 results showed close agreement, the greatest variation being 0.375 g. found and 0.360 g. calcd. A. W. CONTIERI

Quality of water of the Colorado River in 1926-1928. C. S. HOWARD. *U. S. Geol. Survey, Water Supply Paper* 636-A, 14 pp.(1929); cf. Collins and Howard, *C. A.* 21, 2947; 23, 458.—Analyses are given of the water collected at different gaging stations. During 1926-7 (Oct. 1, 1926 to Sept. 30, 1927) the av. load of dissolved material amounted to 36,600 tons per day at Grand Canyon, 37,400 tons at Topock and 39,100 tons at Yuma, Ariz. For 1927-8 (Oct. 1, 1927 to Sept. 30, 1928) the resp. values were 29,400 at Grand Canyon and 26,200 at Yuma. The mean total hardness was 285 p. p. m. in 1926-7 and 254 p. p. m. in 1927-8, as compared with 251 p. p. m. in 1925-6. G. S.

British rainfall, water consumption and water treatment. M. N. BAKER. *Eng. News-Record* 103, 497-500(1929).—Data are given on the recent drought and water shortage, water consumption and water treatment in Great Britain. The consumption in 80% of the cities is between 12 and 47 U. S. gal. per capita per day. Of the 642 supplies tabulated, 241 are filtered and only 28 chlorinated. R. E. THOMPSON

Water-pipe practice at Detroit, Mich. GEORGE H. FENKELL. *Eng. News-Record* 103, 410(1929).—During the last few yrs. Detroit has employed steel pipe almost exclusively for mains larger than 36 in., the principal reasons being the favorable cost and the fact that steel pipe is not subject to sudden failures. In recent contract proposals bids have also been invited on pipe of pure Fe or pure Fe plus a small percentage of Cu. The water supply, derived from the Detroit River, has a hardness of about 100 p. p. m. and is non-corrosive. The soil, in general, is also non-corrosive. R. E. THOMPSON

British water-pipe practice and experience. M. N. BAKER. *Eng. News-Record* 103, 405-7(1929).—An outline of practice in Great Britain. For distribution mains, cast Fe pipe is usually employed. Bituminous coatings, spun in rather than applied by dipping, are generally used for steel pipe. For external protection, use of "Hessian" soaked in bituminous material is quite general. In the clayey London soils, cast Fe pipe sometimes becomes so soft ("graphitic") that it can be cut with a knife. This was formerly attributed to electrolytic action due to inequalities in the Fe, but recent studies seem to show that softening is caused by "clay bacteria." Cast Fe pipe is now surrounded with gravel when laid in clayey soils.

R. E. THOMPSON

Water-works intakes at Hamilton, Ont. H. S. PHILIPS AND JAMES STODART. *Contract Record & Eng. Rev.* 43, 241-4(1929).—The water supply of Hamilton originated in 1859, the source then being infiltration basins on the shore of Lake Ontario. Several intakes have since been constructed which draw water from the lake. The new 60-in. steel intake, constructed in 1926 to avoid a repetition of the ice-blocking experienced in 1923, is described in some detail. The max. velocity of flow through the intake ports will be 1.45 sec.-ft. Before entering the pumping station, the water passes through traveling screens which are housed in the same building as the chlorination equipment.

R. E. THOMPSON

Surface water supply of the United States, 1924. XII. North Pacific Slope drainage basins (B) Snake River basin. NATHAN C. GROVER, G. C. BALDWIN, G. L. PARKER, C. G. PAULSEN, A. B. PURTON AND F. F. HENSHAW. *U. S. Geol. Survey, Water Supply Paper* 593, 264 pp.(1929). (C) Lower Columbia River basin and Pacific Slope drainage basins in Oregon. NATHAN C. GROVER, F. F. HENSHAW AND G. L. PARKER. *Ibid* 594, 215 pp.(1929).

G. SCHWOCH

Surface water supply of Hawaii, July 1, 1923, to June 30, 1924. NATHAN C. GROVER, E. D. BURCHARD AND M. H. CARSON. *U. S. Geol. Survey, Water-Supply Paper* 595, 154 pp.(1929).

G. SCHWOCH

Ground water in the Pomperaug Basin, Conn., with special reference to intake and discharge. OSCAR E. MEINZER AND NORAH D. STEARNS. *U. S. Geol. Survey, Water Supply Paper* 597-B, 73-146(1929).—Some analyses of ground and river water are included.

G. SCHWOCH

Further contributions on the differentiation of organic matter in water. The chlorine combining power of ground water. K. KEISER. *Techn. Gemeindeblatt* 32, 195(1929); cf. *C. A.* 23, 3999.—The Cl demand of ground water gives valuable information concerning the kinds of org. matter present. The ratio of O demand to Cl demand varies greatly.

A. L. ELDER

Artificial production of ground water. E. GROSS. *Gas Wasserfach* 72, 901-5 (1929).—Methods are described of filtering river water through the banks or from artificial infiltration basins, with a preliminary clarification when necessary.

R. W. RYAN

Occurrence of silicates in natural waters. O. W. REES. *Ind. Eng. Chem., Anal. Ed.* 1, 200-1(1929).—In Illinois, it is customary to det. Ca, Mg, NH_4 , sulfate, nitrate chloride and carbonate and est. Na by the difference in milli-equiv. between the cation and anion contents. Better results are obtained if the sol. silicate is added to the other anions.

W. T. H.

Eighth annual report of Ohio Conference on Water Purification, November 1-2, 1928. (1929). Operation of the McDonald water-softening plant. T. S. WOODWARD. *Ibid* 13 —A brief outline. The water supply, obtained from an abandoned coal mine, is hard and contains a considerable amt. of Fe. Lime softening is employed, which also removes the Fe. **Operation of the water-softening plant at Leroy.** A. E. KIMBERLY. *Ibid* 13.—Although the population is but 350, Leroy has a 25,000-gal. per day, intermittently operated softening plant. The hardness of the well water is 570 p. p. m. and of the softened water 85. Air agitation is employed. The filter sand is becoming incrustated. **Operation of the Westerville water-softening plant.** J. H. WENGER. *Ibid* 13 4.—The softening plant of Westerville, constructed at a cost of \$49,000, consists of dry feed lime, soda and alum machines, 2 mech. mixing chambers, 2 coagulation basins and two 300,000-gal. per day filters. The hardness of the raw water, derived principally from Alum Creek, averages about 300 p. p. m., and of the softened water about 90 p. p. m. The cost of chemicals for softening and coagulation averages about \$28 per million gals. **Operation of the Medina water-softening plant.** A. H. FRETTER. *Ibid* 14-5.—The water supply of Medina, derived from a small creek, is hard and at times very turbid, and carries a high bacterial load. The softening and filter plant has a capacity of 1 million gal. per day and consists of chem. feed machines for lime, Na_2CO_3 and alum, a gravity mixing chamber, 2 coagulation basins with CO_2 diffusers at the effluent end and 2 filters. Prior to adopting carbonation considerable incrustation of the filter sand

occurred. The CO_2 is generated by burning coke, gas contg. 12-18% CO_2 being easily obtained. From 3 to 4% escapes before being absorbed by the water. The gas is drawn from the flues by water injectors, the throats of which are made of brass, Fe having been found to last only 6 weeks. The coke consumption is about 200 lb. per million gal. Use of pulverized quick lime at Portsmouth. F. E. SHEEHAN. *Ibid* 21-2.—Lime treatment is employed at Portsmouth to reduce the CO_2 content and excess lime treatment is substituted for chlorination when the raw water contains phenol. Arching of $\text{Ca}(\text{OH})_2$ in the hoppers of dry feed machines and troubles with insol. cores in pebble lime led to the use of ground burnt lime. Shipped in steel containers or paper-lined burlap sacks, it retains its CaO content indefinitely. It can be applied through dry feed machines without difficulty. There is no heat developed during slaking and the reaction is complete. The unit cost is somewhat less than that for $\text{Ca}(\text{OH})_2$. Desirability of metal instead of concrete for exposed open flumes. J. M. MONTGOMERY. *Ibid* 22.—The concrete flume between the mixing tanks and the Dorr clarifier in the Piqua softening plant failed after being in operation 2 years, and has been replaced with a flume of steel boiler plate. Frost action was particularly severe at the water line. J. W. Ellms reported disintegration of the concrete in the filters at Cleveland. Experiment on using broken stone instead of gravel in filter bottoms. O. F. SCHOFFELE. *Ibid* 23-4.—A 4-in. layer of $2\frac{1}{2}$ in. hard dolomitic limestone was placed beneath the original gravel during reconstruction of one of the filters of the Sandusky plant in June, 1928. No trouble has since been experienced with gravel inversion in this filter, no hard spots have developed and the distribution of the wash water is very even. Successful use of crushed stone at other plants was reported, the irregular-shaped rock staying in place better than rounded gravel. The use of steel vs. concrete for wash water tanks. ANON. *Ibid* 24.—A discussion of the relative merits of steel and concrete, in which experience at several plants is outlined. The chief difficulty with the former is leakage, and with the latter, painting and repairing while in operation. A small sand washer and gravel grader. F. E. SHEEHAN. *Ibid* 25-6.—A description of a machine used during reconditioning of the filters at Portsmouth. The use of carbon dioxide scrubber water for removing sand incrustation. J. M. MONTGOMERY. *Ibid* 26-7.—Carbonation is effected at Piqua with CO_2 produced by burning coke, the gas being scrubbed before being applied to the water. Recently the water used for scrubbing has been passed upward through the filter beds to remove the incrustation on the sand resulting from excess lime softening. The alkyl. of this water after passing through the sand has been found to be as high as 1000 p. p. m. In the discussion which followed, the possibility of corrosion being caused by this practice was suggested. C. P. Hoover suggested recarbonation in 2 stages, near the outlet of the mixing chamber and at the inlet to the filters, to prevent sand incrustation. The Lima water-purification plant. E. E. SMITH, 2ND. *Ibid* 31-8. The source of the Lima water supply is Lima Lake and Lost Creek reservoir, into both of which Ottawa River water is pumped. The filter plant, which has a capacity of 8 million gal. per day, consists of chem. feed machines, carbonation equipment, 2 baffled mixing basins, 2 coagulation basins, 6 rapid sand filters and chlorination app. Application of CuSO_4 in the receiving reservoirs has been found to be an effective remedy for short filter runs due to algae. Since 1925, CO_2 , generated by burning coke, has been applied to the water for reducing the alum dosage. The water is hard, averaging about 222 p. p. m. Suggested plant changes to permit softening to be carried out are outlined. New water supply and water purification plant at Wellston. F. E. SHEEHAN. *Ibid* 39-42.—The water supply of Wellston, obtained from Little Raccoon Creek and Lake Alma, is treated in a 2-million gal. per day plant consisting of aerator nozzles surrounded by a lower wall, mech. mixing chambers, a coagulation basin, 2 rapid sand filters and chlorination equipment. The chambers of the rate controllers serve as effluent sight wells or turbidimeters. Tabulated data on the purification effected during 1928 are included. Proposed re-sanding of the Cincinnati filters. CLARENCE BAHLMAN. *Ibid* 43-4.—The Cincinnati filters, after 21 years' service, are to be re-sanded. The effective size of the sand has increased from 0.34 to 0.50 mm., and the acid-sol. content from 1.1 to 50.8%. The incrustation, an analysis of which is given, has increased the depth of the sand bed from 30 to 38.5 in. No decrease in efficiency due to the coarser sand has been observed. Sand loss during washing is confined to the winter months, probably because of the greater density of the cold water. The reconstructed bed will contain 14 in. of gravel and 23 in. of sand. A portion of the old sand will be mixed with new Ohio River sand, purchased at \$1.60 per ton delivered. The equipment used for grading the sand is described. Approx. 73% of the new crude sand is being utilized. In discussion, J. W. Ellms reported that more sand was lost during washing in winter at Cleveland also, because of the greater viscosity of the cold water. During hot weather a 39-in. rise of wash water can be employed, while

in winter the rate is reduced to 24 in. per min. Water softening for small municipalities. CHARLES P. HOOVER. *Ibid* 45-52.—A general discussion of water softening for cities with water consumption up to 1 million gal. per day, and a description of the softening plants at Batavia and New Richmond. The softened water should have a hardness of 70-80 p. p. m. The plant at Batavia, treating Little Miami River water, is of the fill and draw type and consists of chem. feed equipment, 2 settling basins, carbonation chamber and two 0.25-million gal. per day rapid sand filters. Mixing is effected by compressed air. The CO_2 -generating equipment consists of a combined oil furnace, washer, scrubber and dryer. The lime-soda plant at New Richmond consists of 2 wells, chem. feed devices, a combined mixing (baffled) and settling tank, recarbonation equipment and 2 pressure filters, the rated capacity being 0.864 million gal. per day. In discussion, the Glendale fill and draw, lime-soda plant was described. The well water has a hardness of about 290 p. p. m., and the softened water usually varies between 50 and 60. Recarbonation is not employed and the filter sand and hot water pipes are becoming incrustated. The Lowellville zeolite water-softening plant. W. H. KNOX. *Ibid* 53-5.—The new zeolite softening plant at Lowellville is the first municipal plant of this type in Ohio. The capacity of the plant is 350,000 gal. per 24 hrs., but it is only operated for 6 hrs. each day. The water flows upward through 2 ft. of gravel and 9 ft. of zeolite. For regeneration, brine is applied to the top of the filter. The wash water used is approx. 6% of the water softened. The raw well water, which has a hardness of 285 p. p. m., is mixed with the softened water in the proportion of about 19 to 81, giving a product of about 80 p. p. m. hardness. The chem. cost is about 2.8¢ per 1000 gal. of water softened, or 1.36¢ per 1000 gal. per 100 p. p. m. reduction in hardness. The cost of pumping is 3.14¢ per 1000 gal. Bactericidal action of lime in sub-caustic doses. CLARENCE BAHLMAN. *Ibid* 56-9.—Excess lime treatment, sufficient being added to give a caustic alk. of 5 p. p. m., has been successfully employed at Cincinnati on occasions when chlorination has been suspended on account of taste. Recent observations and expts. have shown that greater bacterial removals are obtained when more lime is added than required for coagulation but not sufficient to produce causticity. With normal iron and lime treatment, 30 to 45% of the filter influent alk. is in the form of normal carbonates and the p_H value ranges from 9.0 to 9.3. When using the higher lime dosages experimented with, which were 70 to 90% higher than normal, 50 to 80% of the alk. was normal carbonate and the p_H was 9.4 to 9.5. Markedly better *B. coli* reductions were obtained under the latter conditions. B. believes that the higher removals were more probably due to improved coagulation than to destruction of the organisms, the filter effluent always being more brilliant with the increased lime dosages. The method of treatment is suggested for combating unusual pollution. Continuous use would result in sand incrustation. D. H. Rupp, in discussion, stated that a caustic alk. of 15 p. p. m. at Oklahoma City results in a considerable reduction in bacterial content but does not effect sterilization. Research on removal of phenolic tastes in public water supplies. R. D. SCOTT. *Ibid* 60-3.—Results are given of bottle expts. on the treatment of water contg. 0.01, 0.1 and 1 p. p. m. of phenol. The Cl_2 -consuming power of ammonia still liquor in distd. water was nearly 1 p. p. m. per 1 p. p. m. of phenol after 20 hrs. contact and the O_2 consumed value 2.6 p. p. m. per 1 p. p. m. of phenol. The O_2 consumed value of pure phenol was 1.8 per 1 p. p. m. The min. concn. of phenol which will cause a taste on chlorination varies with different waters, e. g., at Columbus, 10 parts per billion in the raw water and 0.2 parts per billion in the filtered. The min. concn. of phenol detectable by taste in the absence of Cl_2 is 1 p. p. m. In expts. on superchlorination the dosage required seemed to depend on the Cl_2 absorption in 20 hrs. Only a slight residual need be present at the end of this period. Progressive increases in Cl_2 dosage did not result in corresponding increases in residual Cl_2 . It is suggested that the dosage required to produce the first progressive increase in residual Cl_2 might be designated the superchlorination value of the water, the data indicating that this value is a measure of the Cl_2 dosage required to eliminate chlorophenol tastes. Addn. of KMnO_4 reduces the Cl_2 required to eliminate taste, 1 p. p. m. KMnO_4 being as effective as 4 p. p. m. Cl_2 , compared with their relative oxidizing powers of 1 to approx. 0.9. Addn. of NH_3 prior to Cl_2 in proportion of 0.5 to 1 prevented the production of taste from 0.1 p. p. m. phenol when Cl_2 dosages up to 0.5 p. p. m. were employed. Slight taste developed with higher Cl_2 applications. The residual Cl_2 content is higher with Cl_2 and NH_3 treatment than with Cl_2 alone and increases directly with the proportion of NH_3 used. Taste prevention by this method is probably due to the fact that the affinity of chloramine for org. matter is less than that of Cl_2 . E. Watzl discussed the use of activated C for dechlorination. The ratio of C destruction to Cl_2 removed is approx. 1:6. The products are CO_2 and HCl . Filtration rates of 24 to 72 gal. per sq. ft. per min. can be maintained through beds of C 5 ft. deep. The most suitable

size of C is 0.2 in. The phenol recovery and treatment works of the Hamilton Coke and Iron Company, Hamilton, Ohio. B. F. HATCH. *Ibid* 64 9.—See C. A. 23, 3042. Results obtained in phenolic wastes disposal under the Ohio River basin interstate stream conservation agreement. F. H. WARING. *Ibid* 70-80.—See C. A. 23, 4518.

R. E. THOMPSON

Purification experiments on raw water. FRITZ DILLER. *Wochbl. Papierfabr.* 60, 831-2; *Papier-Fabr.* 27, 521-3(1929).—Water taken from a bog varied considerably in O demand, hardness, Fe and Mn content, color and suspended matter with the season. Purification by $\text{Al}_2(\text{SO}_4)_3$ (I), by $\text{Ca}(\text{OH})_2$ and $\text{Al}_2(\text{SO}_4)_3$ (II) and by H_2SO_4 and $\text{Al}_2(\text{SO}_4)_3$ with p_{H} control (III) were compared. I was satisfactory except that it failed to remove the Mn, which would upset bleach plant operation. II removed Mn, but required careful chem. control both in the dosage and in acidifying after filtration to improve the color. III gave more rapid coagulation than either I or II (20 min. vs. $3\frac{1}{2}$ hrs.) but again failed to remove Mn. This can be removed by filtration through a layer of manganous pyrites, which is expensive. The p_{H} 5.5 giving best purification in III was too acid for complete removal of Mn in this way. Complete analyses before and after the various treatments are given.

R. H. DOUGHERTY

Electroosmotic water purification. A. S. BEHRMAN. *J. Chem. Education* 6, 1611-8(1929); cf. C. A. 22, 475.—The demineralization of water may be carried to 10 p. p. m. with a 3-compartment cell. Water purified by electroosmosis compares very favorably with distd. H_2O in purity. Com. installations for ice manuf. are being developed. The only attention required for the app. is the periodic cleansing, every 2 weeks, of the diaphragms by immersion, first in dil. HCl and then in H_2O . C. R. F.

Purification of water by electroendosmosis; the preparation of distilled water by electroendosmosis. K. ILLIG. *Chem. Listy* 23, 408 16(1929); cf. C. A. 23, 459.—Electro distn. is not economical; electroosmosis requires a small space, simple app. and small currents or heat. The hardness of H_2O may be decreased to any degree. This is primarily a review.

FRANK MARESH

Water purification by base exchangers. F. DIENERT. *Chimie & industrie* 22, 249-58(1929).—A brief review of the constitution and properties of artificial zeolites, and of their use and merits for softening water.

A. PAPINEAU-COUTURE

Sterilizing flooded wells. L. S. FINCH. *Monthly Bull., Indiana State Board Health* 32, 19(1929); *J. Am. Water Works Assocn.* 21, 1100.—A heaping tablespoonful of chloride of lime per 100 gal. of water is recommended unless the well has been grossly polluted, when it should be pumped out clean and allowed to refill.

D. K. FRENCH

Katadyn, a new process for the sterilization of water. G. A. KRAUSE. *Schweiz. Apoth. Ztg.* 67, 97-9(1929); cf. C. A. 23, 1452, 1702, 4518.

S. WALDBOTT

Prechlorination and filtration. E. F. DUGGER. *Munic. News and Water Works* 76, 354(1929).—The water from an 844 mg. reservoir (a 200-day supply) is filtered through a rapid sand plant. To 1922 alum was used as a coagulant and filtration costs were \$12.53 per mg. Prechlorination with alum treatment was started in 1923 and better coagulation was obtained resulting in a saving in filtration costs. In 1928 filtration cost with prechlorination and final chlorination was \$7.65 per mg.

C. C. R.

Improvement of taste of chlorinated drinking water by use of activated charcoal filters. KARL IMHOFF AND F. SIERP. *Public Works* 60, 308-9(1929).—See C. A. 23, 4288.

C. C. RUCHHOFF

Operating experiences with large-capacity filter plant. J. CLARK KEITH. *Munic. News and Water Works* 76, 299-301(1929).—The purification plant of the Essex Border Utilities Commission located at Windsor, Ont., has a daily capacity of .21 million imperial gal. The plant is owned by 9 communities and serves 120,000 people. In the spring of 1928 FeSO_4 and hydrated lime were used as coagulants in an effort to increase the length of filter runs during the algae period. Their use increased the min. run from $1\frac{1}{2}$ to 10 hrs. Approx. 15% more wash-water was required when iron and lime were used as coagulants. Mudballs were removed by fishing in the filter beds with a wire-mesh scoop. Lab. control includes daily plankton counts. An attempt will be made to correlate these with the service hours of the filters. Av. costs per mg. include coagulants \$2.09, salaries \$4.28, power \$2.74 and maintenance \$1.24.

C. C. RUCHHOFF

Experiences in zeolite softening. D. E. DAVIS AND J. T. CAMPBELL. *Water Works Eng.* 82, 1153-4, 1169(1929).—A tabulation shows comparisons between the 4,000,000-gal. pressure type softener of the Ohio Valley Water Co., near Pittsburg, Pa., and the 2,000,000-gal. open type softener at Sewickley, Pa. (cf. C. A. 23, 3038). Data and graphs on the operation of the Sewickley plant are given. With the same quantity of salt, a 5% soln. removed 4004 grains of hardness per cu. ft. of green sand (av. 15 runs) while an 8.6% soln. removed 3790 grains (38 runs). The av. salt doses were, resp., 0.334

and 0.353 lb. of salt per 1000 grains of hardness removed. The more dil. soln. apparently allows the salt to bathe each sand grain for a longer period than the more concd. soln. and effects a more complete exchange of Na.

C. H. BADGER

Reduction of carbonate hardness by lime softening to the theoretical limit. CHAS. P. HOOVER AND JAMES M. MONTGOMERY. *J. Am. Water Works Assoc.* 21, 1218-24 (1929).—Ordinary softening with CaO can produce sol. basic Mg compds. To soften to the theoretical limit, excess lime is recommended, followed by recarbonation to remove the excess. It is claimed that this addn. of CO₂ will not make the water more corrosive.

D. K. FRENCH

Coagulation of highly colored waters. W. W. WATKINS. *Munic. News and Water Works* 76, 221-3 (1929).—The Norfolk, Virginia, water supply is obtained from 2 sources. The first, from lakes dammed off from Chesapeake Bay, has a color of 50 to 60 on the Pt Co scale and sometimes reaches 160, and an av. turbidity of 25 with occasional turbidities to 5000. The second, at Lake Prince, has a color of 70 with turbidity from 50 to 200. The combined capacities of the 2 plants are 28,000,000 gal. daily. Prior to 1923 the treatment consisted of the addn. of 2 grains of Al sulfate per gal., settling for 4 hrs., filtration through rapid sand filters, CO₂ reduction with lime and chlorination. Expts. were carried on in the use of liquid Cl in coagulation and a permanent installation was later made. The Cl was applied to the raw water 1 min. ahead of the alum. Six lb. of Cl per million gal. of water were used, maintaining a residual of 0.1 p. p. m. A max. color reduction is obtained by this treatment; filter runs are increased from 16 to 24 hrs.; filter beds are kept in better condition and there is a reduction in bacterial loading.

C. C. RUCHHOFF

Chlorinated copperas as coagulant. A. C. DECKER AND H. G. MENKE. *Munic. News and Water Works* 76, 246-7 (1929).—Chlorinated copperas was found to be practical, economical and efficient in water treatment at the new plant at Chickasaw, Ala.

C. C. RUCHHOFF

The bottled mineral waters. Investigations on their p_H and their content of coli bacilli and other bacteria. JEAN BANCE AND LOUIS CAILLON. *Arch. Inst. Pasteur Tunis* 18, 199-201 (1929).—The p_H was detd. in 21 (apparently French) bottled mineral waters. The values found ranged between 6.0 and 7.6, but different samples of the same brand gave very close checks. Little difference existed between the p_H of bottled and fresh mineral water. The no. of bacteria per cc. was between 0 and 10 in 10 cases, between 10 and 100 in 5 cases, between 100 and 1000 in 3 cases and 400,000 in 1 case. Several waters contained a large no. of molds. Only 1 brand contained coli bacilli (200-500 per l.).

G. SCHWOCH

Experimental studies on the phthalin reaction of certain mineral waters. O. BAUDISCH AND H. V. EULER. *Biochem. Z.* 212, 149-57 (1929).—The phthalin reaction (0.6 cc. of a soln. of 2 g. phenolphthalein and 20 g. NaOH in 100 cc. H₂O reduced with 15 g. Zn-dust, 0.5 cc. 0.01 N H₂O₂ and 0.5 cc. of the tested soln.) is distinct even with 0.00001 mg. hemin-Fe. Various mineral waters (like Saratoga, etc.), were found to give this reaction.

S. MORGULIS

One plant replaces three at water station. C. V. BUCHER. *Ry. Eng. Maintenance* 25, 416-8 (1929).—Trouble with muddy and corrosive water from Leading Creek and the Ohio River at the Hobson, Ohio, terminal of the New York Central RR., was overcome by installation of shallow drilled wells. Automatic electrically operated centrifugal pumps are used in 36 ft. pits. A clear satisfactory water is obtained.

R. C. B.

Reducing corrosion. W. F. DAY. *Munic. News & Water Works* 76, 239-40 (1929).—To ameliorate conditions of the water at Staunton, Va., where red water and iron rust had developed, 60 lb. of NaOH per 1,200,000 gal. of water were used. Cold water pipes were cleared but the hot water continued to give trouble. Stoppages in service and house pipes also appeared owing to tuberculation. A treatment plant is being constructed at a cost of \$14,000 to treat the water with lime, NaOH or Na silicate in order to reduce the future corrosion of the pipe system. To remove the corrosion and stoppage already existing 10% H₂SO₄ was used. Dry steam has also proved quite successful.

C. C. RUCHHOFF

Steel used for large water mains in New York City. WM. W. BRUSH. *Eng. News-Record* 103, 408-9 (1929).—Cast-iron pipe has been abandoned for mains larger than 30 in. in diameter, because of the no. of breaks experienced. Steel mains should be cleaned and recoated in place every 15-25 yrs. Specifications require that the welded longitudinal joints show virtually 100% of the plate strength, break outside the weld in the tensile test and bend cold 180° around a 2 1/4-in. pin without sign of fracture. Single-riveted circumferential joints are employed but are not considered satisfactory as they develop only 56% of the plate strength.

R. E. THOMPSON

Cast iron, steel or reinforced concrete. CALEB M. SAVILLE. *Eng. News-Record* 103, 400-4(1929).—Detailed discussion of choice of material for large water pipe, particularly for mains from sources of supply to the distribution system, from the standpoint of experience at Hartford, Conn. Steel is much more susceptible to corrosion than cast iron. Reduction in carrying capacity of mains in Hartford due to tuberculation has been found to be as much as 28% in 15 yrs. Field coating applied to abrasions is seldom or never as permanent as that applied in the shop. Details are included of "Pabco Soil Proof Wrap," which has been successfully used on steel pipes in the West for some years.

R. E. THOMPSON

Chemical treatment of hydraulic dam cores. F. E. HANCE. *Eng. News-Record* 103, 542(1929).—Research on soil materials available for dam construction in Honolulu disclosed the fact that many of the mountain sandy loams or silts were highly acid in reaction and when agitated with water formed a semi-permanent dispersion without imparting their acidity to the water. On neutralization with soda ash the soil immediately flocculates, forming a well-defined granular deposit of greater permeability than the original soil. If, however, sufficient alkali is added to give a pH value of approx. 10, the pptd. material is of the nature of fatty clay and is 200 to 1000% more impermeable, the voids being reduced to a remarkable extent. The application of the principle to the construction of dams is suggested and is being tried out.

R. E. THOMPSON

Chlorinated copperas and ferric chloride as coagulants. L. H. ENSLOW. *Munic. News and Water Works* 76, 227-9(1929).—Chlorinated copperas as a coagulant is proving to be more effective and cheaper than the older coagulants, alum and copperas with alum. The theory is that the copperas ($FeSO_4 \cdot 7H_2O$) alone has no coagulating effect but the oxidation by chlorination to the ferric state produces rapid coagulation. Ferric Fe produced from the cheapest Fe salt, copperas, and the cheapest oxidizing agent, Cl, makes this process desirable. The copperas is dissolved in a vat which leads to the raw water through a corrosive resistant pipe line. Beyond the vat Cl water is introduced into the pipe line through a rubber hose. One part of Cl to 8 parts of copperas is used. Waters having wide ranges of pH values are efficiently treated with ferric salts. Cost data are given.

C. C. RUCHHOFF

Trickling filter dosing. ANON. *Munic. News and Water Works* 76, 214(1929).—A small experimental sprinkling filter with an area of 0.0016 acre is described. The filter gave a rate of about 2,000,000 gal. per acre per day.

C. C. RUCHHOFF

The fauna of an experimental trickling filter. WM. W. FRYE AND ELMERY R. BECKER. *Sewage Works J.* 1, 286-308(1929).—Protozoan forms were found in abundance in all parts of the filter. Metazoa were also found in all parts but predominated in the lower section. The metazoa increased before sloughing and decreased after sloughing was complete. The opposite was true of the protozoa. The 2 forms fluctuated also with changes in rate of flow and concn. of the wastes. Ten species of *sarcodina*, 9 of *mastigophora* and 14 of *infusoria* were identified. Of the metazoa, forms of *Turbellaria*, *Rotatoria*, *Gastrotricha*, *Nematoda* and *Anneluda* were identified.

E. HURWITZ

Regulation of river pollution. EDWARD ARDERN. *Public Works* 60, 141-2(1929).—A. would set as the min. pollution control requirement the prevention of nuisance and menace to Public Health. He favors the election of River Boards representing all the interests concerned (public, industrial, agricultural, fisheries) to have control over a river, to det. the permissible degree of pollution, to coordinate the control of the existing treatment plants, and to det. and build any new treatment works that would be required to meet the agreed river standard.

C. C. RUCHHOFF

The permissible pollution of water from city sewage purification plants. MAHR. *Techn. Gemeindeblatt* 32, 203-8, 220-4(1929).—The degree of purification necessary depends upon the time, diln. and recreation of the polluted water. Purification should be sufficient so that half the total biochem. O demand is satisfied in 2 days and the dissolved O of the water is not lowered below the usual limits.

A. L. ELDER

The laboratory of the sewage treatment plant. HENRY WEINER. *Sewage Works J.* 1, 358-64(1929).—A chemist's point of view as to what a sewage works lab. should be. Location, ventilation, lighting, storage space, the lab. layout, equipment and app. are discussed in more or less detail.

E. HURWITZ

Encouragement and coordination of sewage research. WILLEM RUDOLPHS. *Sewage Works J.* 1, 276-8(1929).

E. HURWITZ

Some important features of sewage disposal. WYNKOOK KIERSTED. *Munic. News and Water Works* 76, 97-8(1929).—The diln. method of sewage disposal should be supplanted by modern systems involving advance prepn. of sewage. Putrescible matter should be oxidized and suspended matter digested. About 90% of suspended

matter can be removed by settling. Oxidation is accomplished by trickling filters, filtration beds or aeration.

C. C. RUCHHOFF

Trials and tribulations of a sewage works operator. A. W. WYMAN. *Sewage Works J.* 1, 339-42(1929).—W. relates some of the discouraging experiences he encountered at the Pasadena plant and the measures taken to relieve them. Lack of capacity, sludge disposal, air distribution, sludge drying and odors therefrom are the particular offenders mentioned.

E. HURWITZ

Progress of sewage treatment in North America. KARL IMHOFF. *Eng. News-Record* 103, 528-9(1929).—A brief outline is given of observations made during a tour of 40 widely distributed plants in the United States and Canada.

R. E. THOMPSON

Schenectady sewage treatment in 1928. MORRIS M. COHN. *Public Works* 60, 184-5(1929).—The plant was shut down for 3 months in order to clean a trunk sewer and interceptor which had been in service for 13 years. Sludge was withdrawn from the digestion tanks as it became ripe and the plant was put back into operation without any difficulties. All sludge was sold to farmers in 1928 and the demand was not satisfied. The trickling filters returned to efficient nitrification soon after they were put back into operation. The filters reduced the biochem. O demand of the tank effluent by about 67%. The suspended solids in the filter effluent exceeded that in the tank effluent.

C. C. RUCHHOFF

Syracuse sewage treatment works. Summary of four years' operating experience. GLENN D. HOLMS AND W. P. GYATT. *Sewage Works J.* 1, 318-32(1929).—Treatment of sewage consists of screening, grit removal and plain sedimentation in tanks equipped with Dorr clarifiers for rapid removal of sludge. The effluent is discharged without further treatment into Lake Onondaga. The sludge is pumped $2\frac{1}{2}$ miles and disposed of by burial in the lime wastes of the Solvay Process Co. Tables showing the % removal of suspended solids and volume of screenings, grit and sludge removed are given. Construction cost and operating cost data are included.

E. HURWITZ

Blacksburg, Va., sewage treatment plant. R. B. BEGG. *Public Works* 60, 261(1929).—The old plant included an Imhoff tank and contact beds. Secondary sedimentation and glass-covered sludge beds were added and the Imhoff tank was covered and provided with gas collectors to prevent nuisance.

C. C. RUCHHOFF

Sewage treatment at Flint. ANON. *Public Works* 60, 225-7(1929).—The plant at Flint, Michigan, treats an average of 9.6 m. g. d. from a population of 120,000. The plant includes a pumping station, 2 screens and grit chambers and 4 Imhoff tanks. The Imhoff tanks are built on a radial flow plan and consist of 18 hexagonal cells, 6 in an inner ring and 12 in an outer ring. Forty sludge beds are provided. The sewage arriving at the plant is septic and has an av. 5-day biochem. O demand of 326 p. p. m. The tanks have operated satisfactorily reducing the 5-day B. O. D. 54.1%, the total solids 22.2% and the suspended solids 74.8%. The sludge drawn has been well digested with a moisture content of 92.9 and 49.1% org. matter.

C. C. RUCHHOFF

The east side sewage treatment plant of the City of Topeka, Kan. CHARLES A. HASKINS. *Munic. News and Water Works* 76, 339-40(1929).—The plant provides for primary treatment only and is designed for an av. flow of 5.4 m. g. d. The plant consists of a bar screen, grit chamber, 2 Dorr equipped settling tanks, sludge digestion tanks provided with Dorr stirring mechanisms and sludge beds. Chlorination is provided for the influent for odor control and for the effluent to protect water supplies on the Kaw River.

C. C. RUCHHOFF

Sar Bernadino sewage treatment plant. JAMES N. HATCH. *Public Works* 60, 255-9(1929).—The new plant has a capacity of 5 m. g. d. and includes Imhoff tanks, trickling filters, secondary sedimentation tanks and sludge beds. Gas collection and utilization are provided. The plant is also equipped with 4 chlorinators. Cl may be applied at 3 different points ahead of the sprinkling filters for odor control and it may be applied at the influent of the secondary settling tank for sterilization.

C. C. R.

Sewage treatment abroad. WILLIAM RUDOLFS. *Munic. Eng. Sanit. Record* 83, 168-9, 233-4(1929).—See *C. A.* 23, 1707.

C. H. BADGER

Defects at English sewage works. H. C. H. SHENTON. *Public Works* 60, 165-6(1929).—Some English works have by-passes to discharge large quantities of raw sewage directly into rivers without treatment, and though the plant may produce a good effluent a nuisance results. Most English sewers are of the combined type and discharge as storm water any surplus over 3 to 6 times the dry weather flow. The quality of this storm water is often as bad as raw sewage.

C. C. RUCHHOFF

Sewage treatment at Birmingham, England. H. C. WHITEHEAD. *Public Works* 60, 337-40(1929).—The sewage from a population of 1,100,000 is treated in 1 large and 2 small plants. The large plant uses sedimentation tanks, bacterial beds and activated

sludge for a portion of the sewage and utilizes the gases from the digestion tank to operate and light the plant. C. C. RUCHHOFF

Hospital sewage treatment plant. HOWARD E. BAILY. *Public Works* 60, 159-60 (1929).—The sewage treatment plant for the Norfolk County Hospital at South Braintree, Massachusetts, consists of settling tanks, dosing tank and sand filters designed to serve 200 persons. C. C. RUCHHOFF

Sources of error in the determination of organic matter in sewage by the method of Kubel-Tiemann. F. REINHOLD. *Techn. Gemeindeblatt* 32, 215(1929).—Very great errors may occur in the O consumed detn. The principal errors are in the time of heating, character of the material to be oxidized, effect of diln. and the permanganate soln. A. L. KLEDER

Reduction of biochemical oxygen demand of sewage by chlorination. H. G. BAITY AND F. M. BELL. *Sewage Works Journal* 1, 279-85(1929).—The chlorination of sewage exercises a marked effect on the biochem. O demand (B. O. D.). Application of 5 to 7.5 p. p. m. Cl gave no residual and reduced the B. O. D. 7.4%. Eight to 9 p. p. m. gave a Cl residual between 0.0 and 0.1 p. p. m. and reduced the B. O. D. 15.5%. Ten to 15 p. p. m. gave a residual between 0.2 and 0.5 p. p. m. and reduced the B. O. D. 42.7%. The av. of the entire series (39 tests) showed a B. O. D. reduction of 31.7%. Cl can be advantageously applied (1) to retard decompn. in a small stream until sewage can be carried to a point where adequate diln. is afforded; (2) as an adjunct to treatment plants which, though operating efficiently, are not affording the required degree of treatment; (3) as an adjunct to overloaded treatment plants, and (4) for intermittent use on sewage or sewage effluents during dry seasons of the year when the stream flow is low. E. HURWITZ

Suspended and settleable solids in Worcester sewage and Imhoff tank effluent. ROY S. LANPHEAR. *Sewage Works J.* 1, 347-53(1929).—Extensive expts. show that erroneous results are obtained for suspended and settleable solids when samples are composited and allowed to stand. This is explained by the presence of colloidal solids which are easily coagulated. The error is further aggravated by the presence of industrial wastes, particularly lime wastes. E. HURWITZ

Effect of age of fresh solids on digestion. H. HEUKELEKIAN. *Sewage Works J.* 1, 309-17(1929).—No significant differences in the rate of digestion were found between strictly fresh solids and solids allowed to septicize for periods up to 20 days when the solids were properly seeded and incubated at 70° or 80° F., or between neutralized and seeded septic solids and fresh solids. The gas yield from seeded mixts. of septic solids was lower than that from seeded fresh solids. A reduction of 9 to 13% was obtained from solids aged 12 days. E. HURWITZ

Brushwood bacteria beds in South Africa. ANON. *Public Works* 60, 260(1929).—A brief description is given of a sewage filter bed filled with brushwood instead of stone, operated at a rate of 2.75 m. g. d. per acre and delivering a good effluent. C. C. RUCHHOFF

Sludge disposal in Germany. ANON. *Public Works* 60, 163-5(1929).—This is an abstract of a report of a comm. of Manchester, England, on a no. of German treatment plants with regard to sep. sludge digestion and gas utilization. The plants at Essen Frohnhausen, Essen Nord, Rellinghausen, Bochum, Berlin, Munich, Stuttgart and Cologne, all of which utilize the gas produced, are described. The Emschergerossenschaft is building a river purification plant at Karnact. This plant will include 4 sedimentation tanks and will provide a one-hour settling period for 187 million gal. daily. In the Ruhr Valley complete treatment is required in 1 zone of the river from which water supplies are drawn through infiltration galleries. Conclusion: Sludge digestion and utilization are usually the best and most economic means of disposal. C. C. R.

Activated sludge plant operation in Great Britain. A. S. M. PARSON. *Water Works and Sewerage* 76, 397-9(1929).—Three stages of the activated sludge process, clarification, reactivation or restoration of the powers of clarification and nitrification, are discussed. Expts. are described designed to det. the cause of the clarification and it is shown that the clarification reaction follows the adsorption equation of Willard Gibbs. It is inferred from the agreement with the adsorption formula and the loss of activity during clarification that the clarification stage is a phys. or chem. reaction and that the biological work is done during the reactivation or restoration of the power of clarification. It is suggested that the activated sludge process should be sep'd. into the various stages for the more efficient operation of each stage. C. C. RUCHHOFF

Lawton's activated sludge plant. WEBSTER B. BENHAM. *Public Works* 60, 302-6 (1929).—The new plant at Lawton, Okla., is an activated sludge plant of 1 m. g. d. capacity using Simplex mech. aerators. The plant includes 10 aeration tanks, a Dorr

equipped secondary settling tank, a sludge digestion tank, a sludge drying bed and an effluent chlorination chamber. C. C. RUCHHOFF

Results at the Pasadena activated sludge plant. JAMES N. HATCH. *Public Works* 60, 129-32, 186 (1929).—The plant described treats about 7 million gal. of domestic sewage per day. The sewage is screened, aerated in activated sludge tanks and settled in tanks equipped to remove the settled sludge. The clarified effluent is chlorinated at the rate of 25 p. p. m. and is then used for irrigation. The sludge is dosed with 10-14 lb. of alum and 7-14 lb. of Filter Cel, is re-aerated for $4\frac{1}{2}$ hrs. and is filtered through Oliver filters. The sludge is dried in Ruggles-Coles type revolving kilns and is sold for fertilizer. Operating costs in 1928 were \$73.00 per million gal. of sewage and a revenue of \$13.00 per million gal. of sewage was obtained from the sale of fertilizer. C. C. R.

Handling activated sludge on covered beds. WELLINGTON DONALDSON AND A. LAWRIE KURTZ. *Sewage Works J.* 1, 333-8 (1929).—By increasing the rate of return sludge and by doubling the aeration period it was possible to condition the sludge so that it would dry readily on glass-covered beds provided it was not retained in the clarifier. For this purpose the sludge was drawn directly on to the beds from the return sludge line. The beds have been operated equally successfully in winter and in summer. A cake 1 in. thick and contg. 20 to 25% dry solids was produced in 4-5 days. The cake is easily handled with a lifting fork. F. HURWITZ

A county-wide sanitary and health survey. MILFORD E. BARNES. *U. S. Pub. Health Repts.* 44, 2315-30 (1929).—This paper deals with the data compiled during a sanitary and health survey of Darke County, Ohio. The typhoid fever rate is fairly low but not negligible. Undulant fever is a real danger. Water supplies need further safeguarding. The milk supply is being safe-guarded. Methods of sewage disposal are far from ideal. J. A. KENNEDY

A study of rural school ventilation. The school ventilation study in Cattaraugus County, N. Y. THOMAS J. DUFFIELD. *U. S. Pub. Health Repts.* 44, 2383-410 (1929). J. A. KENNEDY

Dust and germ content of air in schools. M. GRÜNEWALD. *Haustech. Rundschau* 32, 241; *Wasser Abwasser* 25, 95. —The influence of ozonization upon the dust and germ content was studied. F. P. GRIFFITHS

House-fly fumigation experiments with calcium cyanide. C. O. EDDY. *S. Carolina Agr. Sta. Bul.* 256, 48 p. (1929); cf. *C. A.* 20, 1490; 23, 3534.—To verify previous recommendations (*C. A.* 21, 3249) house flies (*Musca domestica*) were fumigated with HCN evolved from $\text{Ca}(\text{CN})_2$ used in the proportions of $\frac{1}{8}$ to 16 oz. per 1000 cu. ft. The $\text{Ca}(\text{CN})_2$ was distributed in the fumigating room by the dust cloud method. The highest mortality occurred most frequently at the top of the room, the lowest at the bottom. These variations appeared to be correlated with temp. Toxicity depended on concn. of HCN and exposure time. A dosage that gave satisfactory control in 5-6 hrs. was more economical than one that required longer to produce the same result. C. H. RICHARDSON

Refuse in Greater New York. Abstract of Report by REGIONAL PLAN COMMISSION OF NEW YORK. *Public Works* 60, 194-5 (1929).—A summary of the data on garbage, ashes and refuse disposal in New York since 1905 is presented. The conclusions reached are that the practice of dumping garbage at sea is wasteful and unsanitary and that incinerators should be built in the various communities in the region. C. C. R.

Garbage digestion at Dunedin. ANON. *Public Works* 60, 273 (1929).—Garbage is digested in 5 cells of the Beccari type having a capacity of 50 tons of wet garbage per month on a 30-day retention period basis. C. C. RUCHHOFF

Method of preparing and examining thick films for the diagnosis of malaria. M. A. BARBER AND W. H. W. KOMP. *U. S. Pub. Health Repts.* 44, 2330-41 (1929).—Complete details are given. J. A. KENNEDY

Disposal of industrial wastes. JOHN D. RUE. *Sewage Works J.* 1, 365-9 (1929).—Wastes from the pulp and paper industry are discussed. E. HURWITZ

Prevention of percolation through dams (KITTS) 20. Theory of liquid film formation (FOULK) 2. Old and new methods of treating sugar factory waste waters (JASKÓLSKI) 28. The treatment of waste waters from sugar refineries (JASKÓLSKI) 28. Use and control of steam in the sugar industry (GOODNER) 28. The purification of tannery effluents by means of argillaceous colloids (BESSE) 29. Water resources of the upper McKenzie Valley, Oregon (STEARNS) 8.

Treating sewage. CHESTER G. WIGLEY (one-half to Clyde Potts). *U. S.* 1,730,-

489, Oct. 8. Sewage is collected in a substantially closed but aerated receptacle from which the excess moisture is drawn off, leaving the mass of solid matter spread out over the bottom of the receptacle to a suitable depth, the material is sufficiently heated in the presence of a moderate supply of O and lack of sunlight, and there is propagated in it a fungus which permeates the whole mass in a short time and transforms it into a dry flaky or granular condition with practical freedom from malodorous material. An app. is described.

15—SOILS, FERTILIZERS AND AGRICULTURAL POISONS

J. J. SKINNER

Report on agriculture. J. A. VERRET AND A. J. MANGELSDORF. *Proc. Hawaiian Sugar Planters' Assoc., 48th Ann. Meeting 1928* pp. 279-305(1929); cf. *C. A.* **22**, 3718.—Preliminary expts. indicated that application of molasses to cane fields at the last irrigation before harvesting resulted in a somewhat higher purity of the juice. Application of N fertilizers in quantities corresponding to 100-150 lb. N per acre did not, in general, have an adverse effect on the cane juice, but larger quantities of N did. Fertilization with K salts appears to have a favorable effect on the juice of cane grown on certain types of soil. *Chlorotic condition of cane* was largely controlled by 1 or 2 sprayings with 5% FeSO_4 solns. A large increase in the percentage and speed of germination was obtained by soaking cane seed in 0.5% FeSO_4 solns. as compared with soaking in plain water. Promising results were obtained with a mixt. of HNO_3 and H_2SO_4 as a medium for use in the *maturing of female cane tassels*. Refractometer readings indicated that there was no tendency toward the production of poor quality juices from vigorous cane seedlings.

K. D. JACOB

Farming in Matabeleland. H. G. MUNDY. *Rhodesia Agr. J.* **26**, 564-5(1929).—The "Gusi" sand soil is extremely low in fertility as shown by the following analyses of top and subsoils: P_2O_5 0.003, 0.002; N 0.05, 0.04; K_2O 0.0005, 0.0003; org. matter 1.7, 1.3%, resp. By proper methods of farming and by the use of fertilizers this soil is being made to yield good crops.

A. L. MEHRING

South European red earths. H. HARRASSOWITZ. *Chem. Erde* **4**, 1-11(1928).—Red earths beneath the humus-bearing soil of the Black Forest contain in the HCl ext. a higher silica/alumina ratio, namely 2.5-2.98, than those from farther south. The ratio is as low as 0.17-0.5 in the red earth from Lake Garda in Italy. The latter, like the "terra rossa" of the Karst region, contains free alumina. The "terra rossa" rests on pure limestones, and the red color is not confined to the Mediterranean type of weathering.

B. C. A.

The question of "red earth" formation. ADOLF REIFENBERG. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 257-61(1929).—An answer to criticisms by Harrassowitz (cf. preceding abstr.)

R. M. BARNETTE

Soils. FRANK T. SHUTT. Canada Dept. Agr., *Rept. Dominion Chemist, Year Ending March 31, 1928* 3-14(1929); cf. *C. A.* **23**, 1979.—Mech. and chem. analyses of soils from British Columbia, Ontario, Prince Edward Island, Alberta and Quebec are tabulated. Clay loam soils from the expt. station at Kapuskasing, Ontario, are characterized by a high content of CaCO_3 , the percentages reaching approx. 30 at 3 to 5 ft. *Mine tailings* deposited on farm lands by the spring flood waters of the Massawippi river, Province of Quebec, consisted essentially of Fe pyrites, oxidation of which to H_2SO_4 caused serious damage to crops. Analyses of the top 12 in. of soils from the affected areas showed total S 0.028 to 0.736, sulfide S 0.007 to 0.153 and H_2O -sol. S 0.018 to 0.659%, the pH values ranging from 1.65 to 5.22. The highest concns. of S compds. were in the first 6 in. of soil, but the second 6 in. contained excessive amts

K. D. JACOB

Evaluation of soils from the physical and chemical point of view. J. HASENBÄUMER. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 140-62(1929).—A discussion and review of the phys. and chem. properties of the soil as related to the value of the soil for cultivated crops, stressing the manifold factors which must be properly evaluated from both phys. and chem. viewpoints.

R. M. BARNETTE

A soil survey of Block E (Renmark) and Ral Ral (Chaffey) irrigation areas. J. K. TAYLOR AND H. N. ENGLAND. Council for Sci. and Ind. Research Australia, *Bull.* **42**, 51 pp.(1929).—A classification of the Renmark soils into 4 main types and an explanation of why some are relatively unproductive, why some are susceptible to salting, why others are difficult to irrigate properly, etc. Suggestions are given as to the

best cultural methods to adopt on the various types to obtain the best com. results. There are 2 maps and 9 tables of mech. analysis. E. F. SNYDER

Chemical and agricultural investigations on soils of Monte Pisano (Tuscany). F. ROGAI AND G. ZWEIFEL. *Boll. ist. agr. Pisa* 4, 575-83(1928).—Chem. and mech. analyses and pH detns. of 28 soils of the Monte Pisano district are tabulated. The N content was 1.12-4.20%, P_2O_5 0.46-4.66% and pH 6.3-6.9. G. A. BRAVO

Soil examination by means of conductivity measurements. W. BENADE. *Z. Pflanzenernähr. Düngung* 12A, 293-309(1928).—Elec. cond. measurements of aq. suspensions of soils during the growth of seedlings mark the period of the intake of nutrients by remaining practically const. Control soils without seedlings show a steady rise in cond. with time. This increased cond. is accompanied by a change of soil reaction toward the alk. side. Cond. of soil suspensions is influenced by the length of the soln. period, by atm. CO_2 and by the activity of microorganisms. Soils which have been once extd. with water, filtered and resuspended in water show an increased cond. The new value is characteristic for each soil and is relatively greater for clays than for sandy soils. Math. relationships are obtained to express changes in cond. in soils with continuous leaching. Soils from which practically all sol. salts have been leached show a general parallelism between cond. and humus content. B. C. A.

The Schulz apparatus for mechanical soil analyses in improved form. E. RAUTERBERG. *Z. Pflanzenernähr. Düngung u. Bodenk.* 14A, 261-8(1929).—An improvement in the elutriating app. of Schulz is given. R. M. BARNETTE

Determination and characterization of organic substances in soil. U. SPRINGER. *Z. Pflanzenernähr. Düngung* 12A, 309-17(1928); cf. C. A. 22, 4700.—Existing methods for examg. soil org. matter are discussed. Oxidation processes for detg. org. matter may give fictitious values if the usual relationship, humus = $1.724 \times C$, is adopted. From 40 to 70% of the soil org. matter is humified, the balance being mainly cellulose, lignin and pectin, with C contents of 44, 56 and 40%, resp., and the humus content is more accurately regarded as $2 \times C$. Wet combustion methods for this type of analysis are recommended. In alk. extn. processes for detg. humified material, values depend on concn. and temp. of the solvent and on the period of extn. Non-humified material may be partially extd. Use of NH_3 extn. leads to difficulty in the sepn. of deflocculated clay from the ext. Fifty % pyridine is not a sp. solvent for humus. Where alk. extd. humus is detd. by oxidation with permanganate, results vary somewhat with the concn. of permanganates used and the period of boiling. The ratio humus-C: total C is valuable in the characterization of soil types; and in the examn. of soil profiles the alkali-extractable C expressed as a percentage of the total C content yields information as to the process of soil formation. B. C. A.

The determination of organic carbon in soils. G. W. ROBINSON, W. McLEAN AND RICE WILLIAMS. *J. Agr. Sci.* 19, 315-24(1929).—It is proposed to est. the amt. of org. C in soils by detg. the amt. of SO_2 produced in the ordinary Kjeldahl digestion. The gaseous reaction products are passed through standard I_2 soln., and the excess I_2 is titrated with standard $Na_2S_2O_3$. Details of the method are given. The results obtained with a no. of soils of differing character and origin are compared with those obtained for org. C by dry combustion. The SO_2 method gives results which average $89.6 \pm 1.03\%$ of the combustion figures. It is, therefore, proposed that the % of org. C found be corrected by the factor $100/89.6 = 1.116$. The % recovery of C indicated by the proposed method is somewhat higher for pure substances but still falls short of 100%. The proposed method is applicable to CO_2 soils without correction for inorg. C. It is likely that soils contg. inorg. reducing substances, such as sulfides, will give high results. By absorbing the SO_2 in 25% $Na_2Cr_2O_7$, it is possible to det. the CO_2 by passing the gases through standard $Ba(OH)_2$. The org. C thus indicated agrees with that by the SO_2 method. From data with certain peats it appears that the factor 1.724 for converting org. C to org. matter is too low. P. R. DAWSON

Determination of total carbon in soils. ERIC WINTERS, JR., AND R. S. SMITH. *Ind. Eng. Chem., Anal. Ed.* 1, 202-3(1929).—The dry combustion with 2 g. charge placed in a boat contg. 0.25 g. of MnO_2 gives better results with 10 min. heating than are often obtained by wet combustion. W. T. H.

Effect of the carbon on the vegetation. II. R. PEROTTI AND C. RUSSO. *Boll. ist. agr. Pisa* 4, 465-501(1928); cf. *Ibid* 3, 15(1927).—The crop-producing power of the soils can be greatly improved by the use of 1-3 quintals of finely divided carbon per hectare. This is due to (1) water-retaining power of carbon, (2) easy adsorption of NH_4 salts and (3) less dispersion of nitrates. G. A. BRAVO

Comparison of methods for determining the saturation capacity of soils. P. A. KUTSCHINSKY. *Z. Pflanzenernähr. Düngung* 12A, 392-411(1928).—The methods of

Hissink, Kappen and of Gedroiz for detg. the exchangeable bases in soils (S) give results in close agreement. For carbonate-free soils, Kappen's method is the most rapid. The detn. of the value ($T - S$) (Hissink) is unsatisfactory in soils of high p_H value or of considerable buffer capacity, because of the turbidity of the liquid to be titrated. Duplicate tests, however, show moderately close agreement. The value ($T - S$) can be calcd. as $6.5 \times$ hydrolytic acidity (Kappen). The time required to bring an acid soil to a definite p_H value can also be calcd. from the hydrolytic acidity (Kappen), using the factors 3 for p_H 7.0, 4 for p_H 7.5, 5 for p_H 8.0 and 6.5 for p_H 8.5. Of the methods for detg. the degree of satn. (V), those of Kappen and Gehring show closest agreement with each other and with field-trial results. Hissink's method gives low results and indicates only 50% of the satn. of alkali soils. Gehring's method is advantageous in that the final satn. of the soil with bases takes place at practically the same soil reaction as obtains under natural conditions. Kappen's method is quicker and more convenient in practice.

B. C. A.

Catalytic properties of soils. K. SCHARRER. *Z. Pflanzenernähr. Düngung* **12A**, 323-9(1928).—The published literature of the catalytic properties of soils toward H_2O_2 and iodides is summarized and discussed, and the essential soil factors concerned are differentiated in the 2 cases.

B. C. A.

Lime requirement of soils. S. GOV. *Z. Pflanzenernähr. Düngung* **12A**, 317-8 (1928).—A brief outline of the chem. methods of examg. acid soils, and their significance.

B. C. A.

The determination of the degree of unsaturation and the lime requirement of soils on the basis of the hydrolytic acidity. J. VON CSIKY. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 281-94(1929).—A discussion of the different methods of detg. the degree of unsatn. and the lime requirement of soils.

R. M. BARNETTE

Soil reactions and vines with reference to various lime-sensitive varieties. OTTO SARTORIUS. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 354-70(1929).—Water, sand and soil cultures of several varieties of CaO -sensitive grape vines were made to study the effect of the reaction (p_H value) upon the development of the plant. The grape vines in water cultures made poorer growth with increasing alkali. This injury was the more pronounced in the higher concns. of $Ca(NO_3)_2$. The action of H^+ and OH^- is explained for the most part by their influence on cell permeability. In sand and soil cultures the best growth was obtained with a slightly acid reaction (p_H 6.0-6.5).

R. M. BARNETTE

Comparison between the culture methods of Mitscherlich and Wiessmann [for determining nutrient values of soils]. W. U. BEHRENS. *Z. Pflanzenernähr. Düngung* **12A**, 412-5(1928).—The basis of the methods is examd. mathematically from the point of view of the dependence of the consts. of the growth curves on the nature of the soils and exptl. conditions. In Wiessmann's method the consts. refer to 1 expt. only; those of Mitscherlich are of general application. The accuracy of the results of the pure sand cultures in Wiessmann's method is of vital importance, since they control the corrected values for plant growth in the exptl. sand-soil cultures.

B. C. A.

The application of dialysis and electro-ultrafiltration to the determination of the nutrient requirements of soils. P. KOTTGEN AND R. DIEHL. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 65-105(1929).—The rapid dialyzing app. of Gutbier-Schieber, the Golodetz extg. dialyzing app. and especially the Bechhold electro-ultrafiltration app. have been used in the sepn. of the molecularly dispersed part of the soil from the coarser dispersed part. By dialyzing a sandy soil, a rapid decrease in the p_H value of the dialyzate was noticed while for a clay the H -ion concn. of the dialyzate changed very slowly. Buffer curves for the soils were thus obtained. By using the rapid dialyzer both with hot and cold solns., it was possible to obtain an idea of the soly. of the P_2O_5 in soil solns. The Golodetz extg. dialyzer was better suited than the rapid dialyzer of Gutbier-Schieber for the study of the easily sol. constituents of the soil and the momentary fertilizer requirements, and also for the relationship between the rate of soln. and the mech. compn. of the soil. The electro-ultrafiltration is the best method of sepg. the difficultly sol. constituents of the soil from the colloidal part. In comparison with HCl extn., citric acid extn. and the Neubauer method, the ultrafiltration method agreed most closely with field responses with P_2O_5 fertilization. The electro-filtration method is also of great value in the study of forest soils and the nutrient supply present in the humus. Significant differences were found in the cond. curves of extns. obtained by the electro-ultrafiltration method from well decompd., less decompd. and undecompd. org. matter. Other possible applications are given.

R. M. BARNETTE

Determination of harmful soil acidity. B. TACKE AND T. ARND. *Z. Pflanzenernähr. Düngung* **12A**, 362-90(1928).—Of the total soil acidity, the active acidity and the

base exchange acidity are injurious to plants. The different sensitivities of various plant species to acidity cannot be fully described in terms of soil acidity alone. It is probable that the neutral point in respect to plant physiology is the same as the chem. neutral point. For the effective detn. of injurious acidity, soils should be exhaustively extd. with neutral salt solns. by percolation. A shorter and more rapid process consists in shaking soil for 1 hr. with normal KCl and CaCO_3 . The CO_2 evolved is a measure of the injurious soil acidity. Both org. and mineral soils limed on this basis have a reaction of pH 7. B. C. A.

A rapid electrometric method for determining the chloride content of soils. RUPERT J. BEST. *J. Agr. Sci.* 19, 533-40(1929).—The method described is based on the p. d. set up at the metal-soln. interface when Ag wire, coated with AgCl, is immersed in a soln. contg. Cl ions. Such an electrode is connected, by a 3% agar-satd. KNO_3 bridge, in series with a quinhydrone reference electrode yielding a pos. potential equal to the neg. potential of the Ag-AgCl electrode at the end point of titration of a chloride soln. with AgNO_3 . The 2 electrodes are in series with a tap-key and a galvanometer giving a deflection of 1 division per micro-amp. No potentiometer is used and no external resistance is necessary with such a galvanometer. Four g. of soil is weighed into a 150-cc. Pyrex beaker, about 50 cc. of distd. water added and the suspension shaken by hand for a few sec. and allowed to stand for 5 min. The beaker is then raised so that the Ag-AgCl electrode and the agar tube dip into the suspension, and the tap-key is depressed. The initial deflection gives a rough idea of the amt. of AgNO_3 required. The titration is commenced and the above procedure repeated after each addn. Vigorous stirring with a glass rod is necessary. The galvanometer pointer reverses direction within the range of 0.5 drop. The soil: water ratio has no effect on the amt. of Cl brought into soln.; the same value was obtained for a 1:5 ratio as for a 1:12.5, with soils of high (0.5%) and low (0.002%) Cl content. P. R. DAWSON

Errors in the determination of humus in soils. M. COUTURE. *Giorn. chim. ind. applicata* 11, 149-50(1929).—Three main sources of error in the detn. of humus in the soils are (1) lack of homogeneity of the sample as well as its not being representative; (2) incomplete decompn. of the sample, particularly in calcareous earths; (3) the presence of other org. matter, not humus, but which cannot be differentiated from it. A. W. CONTIERI

The preparation of humus extracts with neutral reagents. KURT SIMON. *Z. Pflanzenernähr., Düngung u. Bodenk.* 14A, 252-7(1929).—NaF is used as an extg. agent for the humus substances of a soil. R. M. BARNETTE

A rapid approximate method of determining the exchangeable bases in non-calcareous soils. W. N. C. BELGRAVE. *Malayan Agr. J.* 17, 206-9(1929).—A rapid approx. method of detg. total bases by the use of $\text{M}/62 \text{ AlCl}_3$ is described. E. F. S.

The influence of substituted cations on the properties of soil colloids. M. S. ANDERSON. *J. Agr. Research* 38, 565-84(1929).—Changes which different soil colloids may undergo when the exchangeable bases are substituted by different cations are studied. The data considered include detns. of heat of wetting, adsorption of H_2O vapor, swelling, moisture equiv., cataphoresis and pH of 7 widely different colloidal materials when satd. with Ca, Mg, K, Na, H and the cation of methylene blue. The order of cation effects on heat of wetting and moisture adsorption is Ca, Mg, Na, H, K and methylene blue, the last ion giving the lowest values. The decreasing order of effects on the remaining properties is approx. Na, K, Ca, Mg, H and methylene blue. The varying effects of the different cations are ascribed to differences in soly. and dissocn. tendency of the colloid-cation combinations and to the consequent differences in the density and diffusivity of the Helmholtz double layer of the colloidal micelles. Soil colloids vary widely in alterability. Furthermore, the ranges of alteration of the different colloids correlate fairly well with the magnitudes of the properties of the untreated or Ca-satd. materials. M. S. ANDERSON

Studies on nitrate formation in soil. I. The periodicity of nitrate formation. SANDRO LIMBACH. *Zentr. Bakt. Parasitenk., Abt. 2*, 78, 354-75(1929).—Nitrate formation with all outside factors identical to the limits of mensurability still shows periodic changes in intensity. In a culture started in the winter and kept under controlled lab. conditions there was a rise in the rate of nitrate formation in the spring and fall and a corresponding drop in summer and winter. The addn. of a large amt. of vegetable extractives slows the rate of nitrification. JOHN T. MYERS

Buffering, acid thickness, soil zones and uniform nomenclature of individual values of soil conditions. S. GOV, P. MÜLLER AND O. ROOS. *Z. Pflanzenernähr., Düngung u. Bodenk.* 14A, 220-40(1929).—A discussion of the soil acidity question. R. M. BARNETTE

Repair of soil filter tubes. G. J. LARSINOS AND A. B. BEAUMONT. *Soil Sci.* 27, 243(1929).—A method of repair is shown by figure. E. F. SNYDER

The use of dextrin in the isolation and identification of *Azotobacter chroococcum*. C. E. SKINNER. *Soil Sci.* 27, 245-6(1929).—The use of dextrin nitrate agar not only facilitates the isolation of *Azotobacter chroococcum* but also prevents one from considering many strains as non-chromogenic. E. F. SNYDER

The methods of direct examination of the microflora and fauna of soil. The introduction of cyanine dyes into the study of soil microorganisms. M. KOFFMAN. *Zentr. Bakt. Parasitenk.*, Abt. 2, 78, 337-52(1929).—A new Grüber dye, water-sol. cyanide is very useful in the direct demonstration of soil organisms. JOHN T. MYERS

The bacterial flora of the soil in respect to the transformation of phosphate. L. HOROWITZ-WLASSOWA. *Zentr. Bakt. Parasitenk.*, Abt. 2, 78, 172-7(1929).—A number of common saprophytic bacteria are capable of splitting phosphates. J. T. M.

The phosphate question. I. The phosphate content of soils and the phosphoric acid fertilization. O. ARRIENIUS. *Z. Pflanzenernähr., Düngung u. Bodenk.* 14A, 121-40(1929).—From a no. of expts. carried out in the field, and from studies of the solv. of soil P_2O_5 in 2% citric acid, it is concluded that a close relationship exists between the P_2O_5 need as indicated by the vegetation expts., and the results of the P_2O_5 soly. in 2% citric acid extns. II. The phosphate analysis. *Ibid* 185-94.—A crit. examn. of the molybdenum blue method for the detn. of P_2O_5 in soils, especially 2% citric acid exts. The method is a rapid, simple and cheap way of making P_2O_5 detns. R. M. B.

Available phosphorus of soil resulting from moisture and temperature variations, Big Horn Mountains, Wyoming. T. J. DUNNEWALD. *J. Am. Soc. Agron.* 21, 934-6(1929).—The available P decreases with increase in rainfall. The more highly leached soils near the top of the range at 9000 ft. elevation and with 28 in rainfall show only $\frac{1}{3}$ the amt. of available P that is found in the arid soils at 6,000 ft. elevation near the base of the mountains. The amt. of available P decreases in the lower soil zones of all the profiles as compared with the surface zones where most of the org. matter has accumulated. This is true in the basic and acid soils. E. F. SNYDER

The changes in the solubility of phosphorus pentoxide in the soil of various biological conditions. L. VON KREYBIG. *Z. Pflanzenernähr., Düngung u. Bodenk.* 14A, 240-51(1929).—The application of artificial P_2O_5 manures to acid soils shows very little utilization of the P_2O_5 as long as the level of true biol. activity is low because of a lack of CaO. The results of the Neubauer analyses are of great value in non-acid and slightly acid soils in which the biol. properties of the soil are not significantly affected. The utilization of P_2O_5 fertilizers cannot be realized in an acid soil until the acid conditions are overcome and a favorable biol. condition exists. With slightly acid soils, an application of CaO is necessary in CaO-loving plants to bring about a most favorable condition for the utilization of P_2O_5 fertilizers. A mobilization of the P_2O_5 of alk. soils is realized under favorable biol. conditions, under which conditions the Neubauer values are valuable in recommending a P_2O_5 fertilization. R. M. BARNETTE

The action of water-soluble mono- and diphosphate on permutite, a contribution to the fixation of phosphoric acid by soil constituents. E. BERL AND PH. SCHMITTNER. *Z. angew. Chem.* 42, 351-5(1929).—The possibility of the fixation of H_2O -sol. P_2O_5 by colloidal Al silicate in soils was pointed out and it was shown that permutite as a typical substance for these soil constituents absorbs P_2O_5 out of the H_2O -sol. mono- and diphosphates, as they occur in the usual fertilizer, and out of aq. exts. of the same (superphosphate and nitrophoska). By long treatment of Na permutite with monoalkali-phosphate solns. of increasing concns., products were obtained in which phosphoric acid in the amt. of 1 mol. P_2O_5 and more were combined with fundamental substances with approx. 3.3 mol. SiO_2 and 1 mol. Al_2O_3 , in smaller part as sol. alkali-phosphate and in larger part as insol. Al phosphate. The properties of the products were explained and the conversion was regarded as an example of a topochem. reaction. The P_2O_5 of the products was 95% citrate and 100% citric acid sol. E. F. SNYDER

Sparingly soluble phosphates of physiological importance to plants. E. UNGERER. *Z. Pflanzenernähr. Düngung* 12A, 349-62(1928).—The amt. of H_3PO_4 extd. from the *tert.* phosphates $Mg_3(PO_4)_2 \cdot 22H_2O$, $MgNH_4PO_4 \cdot 6H_2O$, $Ca_3(PO_4)_2$, $AlPO_4$ and $FePO_4$ is affected by the reaction of the extg. soln. and the presence in it of electrolytes and univalent permutites. Neutral salts decrease the soly. of Fe and Al phosphate and increase the pH value of the soln. Clay and K and NH_4 permutites adsorb Ca and Mg ions from the above phosphates, and an equiv. amt. of phosphate appears in soln. In soils, Fe and Al phosphates in the presence of neutral salts are involved in base-exchange activities, and titratable hydrated Al_2O_3 is found in soln. The value of these phosphates as plant nutrients depends on the water and chalk content, and on the reaction

of the soil. When the soil moisture rises to 90% of the max. capacity, AlPO_4 has a greater nutrient value than CaHPO_4 . Soil reactions more acid than $\text{pH } 5$ decrease the nutrient values of Fe and Al phosphate.

B. C. A.

Percolation experiments. I. Nitrification and effect of cover plants. W. N. C. BELGRAVE. *Malayan Agr. J.* 17, 192-205(1929).—Observations are reported on N losses from soils under covers, bare and enriched by N fertilizers.

E. F. SNYDER

The second approximation of the theory of growth factors. E. A. MITSCHERLICH. *Z. Pflanzenernähr. Düngung* 12A, 273-82(1928); cf. C. A. 23, 1711.—The theory of growth factors is extended to include the depression of crop yields resulting from the supply of nutrient in amts. greater than the optimum. Exptl. work can be expressed in math. form. The growth-depression factor is influenced by the nature of the deficient nutrients and of the soil, the buffer capacity and water-retaining capacity of the soil, and by climatic conditions. Much of the exptl. evidence of the opponents of the constancy of the growth factor is considered unsatisfactory because of lack of consideration of the "depression factors."

B. C. A.

The availability of potash in a typical Mauritius soil. N. CRAIG AND R. LINCOLN. *J. Agr. Sci.* 19, 397-403(1929).—The results obtained by Dyer's and Hissink's methods show a fairly close agreement, indicating that for the lateritic soils encountered in Mauritius the former method gives reliable data in so far as K availability is concerned. Application of K salts to these soils results in a gradual increase in the amt. of non-available or non-exchangeable K. When equiv. applications of K_2SO_4 and KNO_3 are made, the increase is greater with the former. When molasses is applied there is a decrease in the amt. of non-available or non-exchangeable K, showing that the K in the molasses has remained in the available or exchangeable forms. The decrease is due to the conversion of the non-available forms pre-existing in the soil into available forms, while the K pre-existing in the soil tends to become more available.

P. R. DAWSON

Studies on the exchangeable potassium. K. BANBERG. *Z. Pflanzenernähr., Düngung u. Bodenk.* 14A, 177-84(1929).—For org. (turf) soils, the bivalent Ca and Mg ions bring into soln. from the org. complex more replaceable K than the univalent Na and NH_4 . In the clay part of the soils more replaceable K was exchanged by NH_4 while the other cations were practically the same. On the basis that the Ca exchanges with replaceable K of humus to a greater extent and NH_4 exchanges with the K of clay to a greater extent, a series of soils was treated with NH_4 and Ca salts to ascertain the different amts. of K in combination with humus and clay. Replaceable K was in combination with clay for the most part. 0.1 N NH_4 acetate soln. was found a suitable means of detg. the replaceable K. In a series of soils with increasing degrees of acidity, the utilization of the replaceable K in Neubauer tests was greatest in the less acid or near neutral soils.

R. M. BARNETTE

The relation between concentrations of potassium in culture solutions and optimum plant growth. R. P. BARTHOLOMEW AND GEORGE JANSSEN. *Soil Sci.* 27, 189-203 (1929).—See C. A. 23, 4497.

E. F. SNYDER

The cobaltinitrite (volumetric) method of estimating potassium in soil extracts. G. MILNE. *J. Agr. Sci.* 19, 541-52(1929).—A volumetric form of the cobaltinitrite method is described. An aliquot of the soln. prepd. for analysis (neutral and free from NH_4 salts and org. matter), representing 5 to 25 mg. K_2O , is evapd. to about 10 cc. Ten cc. each of satd. NaCl and 10% CoCl_2 and 15 cc. of 10% NaNO_3 are added in the order given, mixed, and the mixt. is evapd. to stiff pasty condition or hard dryness. After cooling, 10 cc. of 10% HOAc is run in and the mixt. well stirred to dissolve excess reagents and NaCl. After 15 min. standing, 10 cc. of water is stirred in and the mixt. filtered with suction through a small Gooch crucible, using a disk of No. 40 Whatman paper covered with a layer of the finer particles from a suspension of glass dust in water. The ppt. is washed by decantation with 2.5% Na_2SO_4 , transferred to the crucible and washed 6-8 times with the same wash-liquid. By allowing for an excess of at least 10 cc., a measured quantity of 0.05 N KMnO_4 is dild. and brought to a boil, 10 cc. of dil. H_2SO_4 added, the soln. again boiled and removed from the flame, and the ppt. in its crucible immediately added, stirred around well and the beaker covered and set aside for 10 min. A measured vol. of standard $(\text{COOH})_2$, sufficient to give a clear soln., is added, the crucible removed and the excess titrated with the same 0.05 N KMnO_4 . A complete "blank" analysis should be run for each new set of reagents. The corrected vol. of KMnO_4 is converted to its equiv. of K by the factor 0.000415 g. K_2O per cc. 0.05 N KMnO_4 . This method permits of quantitatively accounting for known amts. of K regardless of the presence of alk. earth sulfate or P_2O_5 , provided that the amt. of K is not varied over too great a range. The factor adapted suits the procedure described over a range of about 3-50 mg. of K_2O . The method is applicable to plant-

ash analyses, regardless of their content of other bases and phosphates or of the mixed sulfate weighed for Na and K together. For small quantity work on soils it is more exact than the perchlorate method. Citric acid exts. can be handled. Some analyses of NH_4Cl exts. were unsatisfactory. Attention is called to the desirability of setting exchangeable K detns. on a firmer analytical basis by investigation of methods of freeing the exts. from NH_4 salts. P. R. DAWSON

The span of p_{H} values in water and potassium chloride solution. S. GOY AND BUROW. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 348-54(1929).—The difference in the p_{H} value of a soil in aq. suspension and in a KCl soln. gives valuable information concerning the possible injury to plants if the antilogarithmic value (the difference in actual H-ion concn.) is used. The greater the difference of the 2 values the more liable the soil is to be injurious to plant growth. R. M. BARNETTE

The potassium oxide-iron antagonism in the plants as basis of a method for determining the potassium oxide requirements of soils. O. ECKSTEIN AND A. JACOB. *Z. Pflanzenernähr., Düngung u. Bodenk.* **14A**, 205-20(1929).—The method of Hoffer is correlated with the Fe and K_2O content of corn to show that in many instances the accumulation of Fe in the internodes of corn is an indication of an insufficient supply of K_2O for the corn plant. R. M. BARNETTE

Abo-Abo soils respond to potash. PHILIPPINE SUGAR ASSOCIATION STAFF. *Sugar News* **10**, 471 6(1929). V. G. LAVA

Investigational work with fertilizers. FRANK T. SHUTT Canada Dept. Agr., Rept. Dominion Chemist, Year Ending March 31, 1928, 14-33(1929); cf. C. A. **23**, 462. — Applications of Ephos basic phosphate gave as high yields of mangels as equiv. amts. of superphosphate and basic slag. Analyses of limestone, marls, peats, mucks and miscellaneous fertilizer materials are tabulated. A sample of phosphatic waste from a steel plant contained P_2O_5 30.04, BaCO_3 11.58 and acid-insol. matter 2.96%. K. D. J.

The leaching out of autumnal dressings of nitrogenous fertilizers. H. H. NICHOLSON AND BARBARA PANTIN. *J. Agr. Sci.* **19**, 297-301(1929).—The loss, by leaching, of N from CaCN_2 applied in the fall was studied by estn. of nitrate in drainage or leachings from soil treated with it. For comparison, similar studies were made with $(\text{NH}_4)_2\text{SO}_4$ and rape dust. The expts. were conducted in glazed pots with a tubulure at the bottom of the side, set up outdoors so as to receive moisture from rainfall only. A medium loam soil was used. The results indicate that leaching out may occur any time throughout the winter up to March, or rarely April. The loss of nitrate is directly limited by the amt. of drainage and so is indirectly detd. by rainfall, and by temp. which affects the rate of evapn. All three N fertilizers are shown to lose well over 50% of a normal dressing by leaching during the winter. The loss is greatest with $(\text{NH}_4)_2\text{SO}_4$, least with rape dust and intermediate with CaCN_2 . P. R. DAWSON

What quantity of fertilizer to use. A preliminary study of the fertilizer requirement of the red Victorias soils. CARLOS L. LOCSIN. *Sugar News* **10**, 521-33(1929).—L. applied Spillman's yield equation based on the law of diminishing returns to the results of 4 field expts. in Victorias (Negros, P. I.), and found that with a tenant receiving 45% of the sugar at \$4.50 per picul, 450 kg. of ammophos per hectare would be the most profitable quantity of fertilizer to apply. V. G. LAVA

Phosphoric acid gives big increased yields in uplands of La Carlota District. PHILIPPINE SUGAR ASSOCIATION STAFF. *Sugar News* **10**, 452-6(1929).—Phosphoric acid in conjunction with N fertilizers gives a big increase of sugar in the uplands of La Carlota district. Investments in potash are not as yet warranted. V. G. LAVA

The stimulating effect of external applications of copper and manganese on certain chlorotic plants of the Florida Everglades soils. O. C. BRYAN. *J. Am. Soc. Agron.* **21**, 923-33(1929).—Plant responses (cowpeas and sorghum) were almost as good where the Cu and Mn sulfates were applied to the leaves as where they were applied to the soil. Plants on the untreated soil made very little growth, while those on the treated soil made very good growth. Plants grown on the Cu-treated soil contained appreciable quantities of Cu while those on the untreated soil had only traces. Plants receiving Cu and Mn produced mature seed, while the untreated ones failed entirely. The raw peat soils of the Florida Everglades are deficient in available forms of Cu and Mn. E. F. SNYDER

Fertilizing with iodine. F. G. DOERELL. *Z. Pflanzenernähr. Düngung* **12A**, 344-9(1928).—Application of I (as KI) at the rate of 3.2-4.3 kg. per hectare increased the yield of hops, but higher proportions (5.4 kg. per hectare) caused considerable crop reduction. In no case was the increased value of the crop as great as the cost of iodide used. The I present in Chilian saltpeter and in superphosphate is sufficient to show

a small but definite effect in the crop. Iodides improve the color of the hops and decrease the I no. and tannin content. B. C. A.

Some observations on the nitrogenous manuring of grassland. H. W. GARDNER, J. HUNTER SMITH, J. W. REID AND R. H. WILLIAMS. *J. Agr. Sci.* 19, 500-23(1929).—Applications of N equiv. to 400 lb. of $(\text{NH}_4)_2\text{SO}_4$ per acre increased stock-carrying capacity approx. 50% in 1927; in 1928 applications equiv. to 300 lb. $(\text{NH}_4)_2\text{SO}_4$ per acre gave an increase of 20%. The dry matter of the herbage on the N plots contained an av. of 17.7% crude protein as compared with 15.5% where no N was applied.

P. R. DAWSON

The competition between cultivated plants and soil microorganisms for mineral nutrition; action of dried blood on phosphatic fertilizer. D. CHOUGHAK. *Compt. rend.* 189, 262-4(1929).—The expts. offer a new example of antagonism between the higher plants and the soil microorganisms. It is quite probable that this competition for nutrient is produced very often in practice and may extend to the different elements necessary for life: P_2O_5 , K, Ca, Mg and even nitrate. This is the result of too great a disproportion between the different mineral nutritive elements of the soil and the energy-producing elements. As a remedy, one may add fertilizer while observing the necessary proportions between the different elements. E. F. SNYDER

Investigations on yield in cereals. VI. A. A developmental study of the influence of nitrogenous top-dressing on wheat. B. A measurement of the influence of disease ("Take-all") upon the yield of wheat. L. R. DOUGHTY, F. L. JENGLEDOW AND T. K. SANSOM. *J. Agr. Sci.* 19, 472-90(1929).—With winter wheat a late February top-dressing with $(\text{NH}_4)_2\text{SO}_4$ at a rate of 150 lb. per acre did not increase ear-formation. The yield, however, was increased to a rate of 26.4 bu. per acre as compared with 19.1 bu. per acre on the untreated plots. P. R. DAWSON

The relation of sodium nitrate and certain other nitrogen carriers to the development of chlorosis in rice. W. H. METZGER AND GEORGE JANSSEN. *J. Agr. Research* 37, 589-602(1928). NaNO_3 and other nitrates are rapidly reduced in submerged rice soils. The exptl. results indicate that N is lost in the reduction process by denitrification. Ammonification progressed slowly for the first 4 or 5 weeks following submergence, except where an abundance of org. matter was present, and the plants became chlorotic. Chlorosis was overcome as ammonification progressed. NaNO_3 had a slight tendency to hasten the change of the soil reaction toward alk. by flooding, and $(\text{NH}_4)_2\text{SO}_4$ to retard it. Chlorosis became marked in nearly all cases before the soil reaction reached p_{H} 6.0. Where an abundance of org. matter was present in greenhouse soil and in field soil, chlorosis did not appear although the reaction of the soil reached p_{H} 7.0 or slightly above. Spraying FeSO_4 on the leaves of chlorotic plants failed to correct the condition and the addition of ferric citrate to the flood water for this purpose likewise failed. A second application of N while the plants were chlorotic greatly improved their color and vigor. This appears to be good evidence that chlorosis in rice is due to a lack of available N, particularly in the form of NH_3 , rather than to an impaired availability of Fe due to an alk. reaction of the soil. W. H. ROSS

United States insecticide statistics for 1928. R. C. ROARK. *J. Econ. Entomol.* 22, 699-701(1929).—Imports and exports of the principal insecticides are given for 1928, also some information on the production and carry-over of arsenicals. C. H. R.

Insecticides and fungicides. FRANK T. SHUTT. Canada Dept. Agr., *Rept. Dominion Chemist, Year Ending March 31, 1928*, 78-83(1929); cf. C. A. 23, 466.—Injury to apple trees caused by applications of Cu dusts for control of the apple sucker paralleled the degree of infestation by the insects, and was found to be due to the reduction of the Cu compds. by the "honey dew" secreted by the insects. Detns. were made of the amt. of As rendered H_2O -sol. when 14 samples of *Paris green* were digested for 24 hrs. with (1) previously boiled distd. H_2O at a const. temp. of 32° , (2) previously boiled distd. H_2O at $23-25^\circ$, and (3) distd. H_2O , not previously boiled, at $23-25^\circ$. In all cases the largest amts. of sol. As were obtained by (1) and the smallest by (2). Efficient spreading of waste crankcase oil on water was obtained by adding up to 1% of a more volatile oil such as crude cresylic acid or tar acid oil. K. D. JACOB

Some limiting factors in the use of saturated petroleum oils as insecticides. HUGH KNIGHT, JOSEPH C. CHAMBERLIN AND CHAS. D. SAMUELS. *Plant Physiology* 4, 299-321(1929).—The bad effects frequently observed on fruit trees from the use of satd. petroleum oils are due to phys. rather than to chem. handicaps caused by the penetration of the oil into the plant tissue. By means of a special staining technic, which is described in detail, it was noted that beginning within a few days after entrance into the intercellular spaces of citrus and extending over a period of many months in a satd. petroleum oil of 106 seconds viscosity, the oil is taken into the vascular system of the

plant and translocated to the storage tissues. Conclusion: Heavy white oils (of a viscosity exceeding 60 seconds *Sayboldt*) must be used sparingly and with a great degree of caution, if, in the future, serious ultimate injury is to be avoided. W. T.

Pyrethrin I and II. Their insecticidal value and estimation in pyrethrum (*Chrysanthemum cinerariaefolium*). F. TATTERSFIELD AND R. P. HOBSON. *J. Agr. Sci.* 19, 266-96(1929).—Pyrethrin I and II were isolated by the method of Staudinger and Ruzicka (*C. A.* 18, 1818-20). Both are highly toxic to *Aphis rumicis*. Pyrethrin I was found to be the most toxic substance so far tested, being about 10 times as toxic to these insects as pyrethrin II. It is probably mainly responsible for the contact insecticidal value of pyrethrum. Two microanalytical methods of detg. pyrethrin content based on macro methods of Staudinger and Harder (*Ann. acad. sci. Fennicae*, A, 29, No. 18 [1927]) are described: (a) by means of the acids after hydrolysis and (b) by means of the semicarbazone. The analytical results obtained for a series of pyrethrum samples agreed with their observed insecticidal properties to *A. rumicis*. Comparisons of the pyrethrin contents as estd., with the results of direct toxicity expts. both on the pyrethrum samples and the pure pyrethrins, confirm the validity of the analytical methods. There was a significant and positive correlation, in the samples tested, between the amts. of pyrethrin I and II. Insufficient data are available to show a significant correlation between the size of flower heads and the content of poison, or to draw conclusions as to the effect of external conditions such as soil, weather or age of bed. P. R. DAWSON

Pyrethrin I and II. Their estimation in pyrethrum (*Chrysanthemum cinerariaefolium*). F. TATTERSFIELD AND R. P. HOBSON. *J. Agr. Sci.* 19, 433-7(1929); cf. preceding abstr.—The acid method previously described has been used to evaluate samples of pyrethrum derived from both Swiss and Japanese seed, with equally successful results. A modification of the acid method providing a rapid assay of pyrethrum by detn. of pyrethrin I is described in detail. P. R. DAWSON

Activity of pyrethrum powders. GIOVANNI ISSOGGIO. *Ann. Schiapparelli* 3, No. 5, 10-2(1929).—Samples of pyrethrum from Dalmatia (*Chrysanthemum cinerariaefolium*) and from Caucasus (*Pyrethrum roseum*) contained, resp.: moisture 10.15, 11.72; ash 7.04, 8.44; Et₂O ext. 5.15, 5.75; alc. ext. 19.14, 18.00; tannin (Lowenthal's method) 4.44, 4.38%. The activity is detd. by placing in an 18 × 2-cm. glass tube 0.5 g. powder and some insects. Fleas, bugs, ants and beetles are paralyzed within 1/4-1/2 hr., flies within 1/2-3/4 hr. When the material is sophisticated, these times are longer. G. A. BRAVO

Evolution of hydrocyanic acid from calcium cyanide. H. D. YOUNG. *Ind. Eng. Chem.* 21, 861-3(1929).—With any given Ca(CN)₂ the rate of evolution of HCN increases with increasing relative humidity. With a calcium cyanide, 80% of which passes through a 200-mesh sieve, commercially satisfactory evolution of HCN (90% more) will occur in about 2 hrs. with a relative humidity of 50% or more. E. F. S.

The fungicidal properties of certain spray-fluids. V. W. GOODWIN, H. MARTIN AND E. S. SALMON. *J. Agr. Sci.* 19, 405-12(1929).—A soln. of di-Ca-H arsenate at a strength of 0.0125% As₂O₅ was fungicidal to the conidial stage of *Sphaerotheca humuli*, while at 0.006% As₂O₅ it was not quite fungicidal. Lime casein contg. Ca(OH)₂, when added as a spreader to Ca arsenate, reduced the fungicidal properties of the Ca arsenate spray. A soln. of Ca thioarsenate at a strength equiv. to 0.006% As₂O₅ was fungicidal to *S. humuli*, while at 0.003% As₂O₅ it was below fungicidal strength. It is suggested that the increased fungicidal properties of the mixed lime sulfur-lead arsenate spray are due to the presence of Ca thioarsenate. P. R. DAWSON

Facilitating the removal of the spray residue. R. H. ROBINSON. *J. Econ. Entomol.* 22, 693-8(1929).—This is a lab. study of the removal of PbHAsO₄ spray residues from apples. Settling of dust on the residue in the calyx and stem ends of apples increases the difficulty of removal. Any compd. or substance that is insol. or slightly sol. in water facilitates the removal of PbHAsO₄ residue by the HCl treatment. From 1 to 2 lb. Ca(OH)₂ per 100 gal. PbHAsO₄ spray mixt. should materially aid in the removal of the residue. C. H. RICHARDSON

Spraying for the control of onion thrips in Massachusetts. A. I. BOURNE. *J. Econ. Entomol.* 22, 679-83(1929).—The onion thrips (*Thrips tabaci*) is not effectively controlled by dusts. Nicotine sulfate in soln. with K fish oil soap has given excellent results. Although toxic to the insects, oil sprays do not adequately cover the plant surfaces. A power sprayer for com. onion spraying is described. C. H. RICHARDSON

Hydrated lime in summer sprays for the control of the oriental fruit moth. A preliminary report. L. A. STEARNS AND R. B. NEISWANDER. *J. Econ. Entomol.* 22, 657-60(1929).—Heavy applications (10-25 lb. to 50 gal. water) of Ca(OH)₂ with or

without other insecticides gave promising control of the oriental fruit (peach) moth (*Laspeyresia molesta*). The coating of $\text{Ca}(\text{OH})_2$ acts as a phys. and mech. hindrance to oviposition, hatching and entrance of larvae into twig and fruit. Results of practical expts. are given. C. H. RICHARDSON

Miscellaneous codling moth studies. L. F. STEINER. *J. Econ. Entomol.* 22, 648-54 (1929).—Bands treated with β -naphthol killed 97% of the larvae of *Carpocapsa pomonella*, captured and repelled 10-20% of the larvae. α -Naphthylamine appears to be as effective as β -naphthol. Biol. data on the larvae are also included. C. H. RICHARDSON

Banding for codling moth control. W. P. FLINT AND C. C. GOFF. *J. Econ. Entomol.* 22, 675-9 (1929).—Chemically treated bands of various types of fabric were used to capture and kill codling moth larvae (*Carpocapsa pomonella*). *o*-Toluidine, monochloronaphthalene, β -naphthol, *o*-dichlorobenzene, petroleum lubricating oil emulsion and Na_2SiF_6 were used in various mixts. Mixts. of 1 part monochloronaphthalene or 1 part *o*-toluidine in 10 parts lubricating oil gave the best results. When these materials were used on crepe paper bands, severe injury resulted within 5 months. β -Naphthol in lubricating oil was less injurious to the tree. C. H. RICHARDSON

Codling moth bait trap studies. L. F. STEINER. *J. Econ. Entomol.* 22, 636-48 (1929).—A large no. of baits contg. fermenting carbohydrate material, fruits and fruit juices and a no. of esters and other org. compds. in various mixts. were tested as attractants for the adult codling moth (*Carpocapsa pomonella*). A low-grade molasses in aq. soln. contg. geraniol was most attractive. Pure chem. compds. used alone were of no value. The use of bait traps was uneconomical in orchards where the codling moth injury was held to less than 10% by other means. Methods of trapping are discussed. C. H. RICHARDSON

A determination of the lethal dosage of arsenic for Missouri and Colorado codling moth larvae. LEONARD HASEMAN AND VIRGIL F. BURK. *J. Econ. Entomol.* 22, 655-6 (1929).—Known amts. of As_2O_3 in aq. soln. were fed to larvae of *Carpocapsa pomonella* from Colorado and Missouri to det. whether the Colorado individuals were more resistant to As than the Missouri individuals. The results do not support Hough's contention (C. A. 2634) that the Colorado larvae are more resistant than larvae from localities farther east. C. H. RICHARDSON

Attempts to protect sweet corn from infestations of the corn-ear worm, *Heliothis obsoleta* (Fabr.). STANLEY B. FREEBORN AND FLOYD H. WYMORE. *J. Econ. Entomol.* 22, 666-71 (1929).— Na_2SiF_6 , extra light, 70-75%, and pyrethrum ext. were the most effective insecticides tried against the corn-ear worm; black pepper proved to be the most satisfactory repellent for the adult moth. C. H. RICHARDSON

Observations on the carrot rust fly (*Psila rosae* Fab.) in Massachusetts. W. D. WHITCOMB. *J. Econ. Entomol.* 22, 672-5 (1929).—Preliminary expts. with derris powder and exts., HgCl_2 and Na_2SiF_6 were promising. The paper also contains life-history information. C. H. RICHARDSON

High-nicotine tobacco. R. C. COLLISON, J. D. HARLAN AND L. R. STREETER. N. Y. State Agr. Expt. Sta., *Bull.* 562, 19 pp. (1929).—Expts. on the growing of high-nicotine tobacco in N. Y. for insect control are described. *Nicotina rustica* and certain varieties of *N. tabacum* were used. Variability in yield is discussed. From 100 to 150 lb. nicotine per acre was obtained. The impracticability of growing nicotine on the av. farm for spray purposes is stressed. C. H. RICHARDSON

The onion maggot situation in New York. HUGH GLASGOW AND HAROLD T. COOK. *J. Econ. Entomol.* 22, 683-8 (1929).—Petroleum lubricating oil emulsion contg. Bordeaux mixt. is the most efficient spray for the onion maggot (*Hyalemyia antiqua*). Practical control measures are discussed. C. H. RICHARDSON

Combating the grain beetle (*Calandra granaria*). KURT SEIDL. *Z. ges. Getreidew.* 15, 35-44, 61-9; *Chem. Zentr.* 1928, II, 284.—The following substances were used in lab. tests: H_2S , AsH_3 , CS_2 , CCl_4 , SO_2 , NO_2 , Et_2O , CH_3O , MeOH + CH_3O , HCO_2Me , AcOEt , Cl , HCN , O_2 , N_2 , H_2 , CO , CO_2 and a mixt. of aniline and clove oils with xylene. HCN , CS_2 , AsH_3 , CCl_4 , H_2S , HCO_2Me and EtOAc gave the most promising results. The use of heat or vacuum is not economically feasible. C. R. FELLERS

The downy mildew of the hop in 1928. E. S. SALMON AND W. M. WARE. *J. Inst. Brewing* 35, 20-5 (1929).—In 1928 downy mildew seriously attacked the tips of trained-up vines, resulting in a diminished crop and early picking, which injured brewing value. Spraying with Bordeaux mixt. was tried out and it was found that a fine misty spray was needed to avoid "scorching" of the growing leaves. PETER J. F. WEBER

Chemical treatment to shorten the rest period of sugar-maple trees. C. G. DEUBER AND P. R. BOWEN. *Science* 70, 102 (1929).—Ethylene chlorohydrin is used for forcing

woody plants in the study of a fungus disease. Its effects on the host leaves are described. E. F. SNYDER

Experiments on the eradication of Canada thistle, *Cirsium arvense*, with chlorates and other herbicides. ALFRED ÅSLANDER. *J. Agr. Research* 36, 915-34 (1928).—A late autumn application of 200 kg. of NaClO_3 , or 250 kg. of KClO_3 , per hectare killed the roots of Canada thistle during the winter, without injury to oats that were sown on the plots the following spring. An early spring application was less effective. Other herbicides tested had practically no effect. The effectiveness of chlorates is due to their rapid penetration through soil and to their slow decompn., especially at low temps. NaCNS and to a greater extent NaCN decompose so rapidly in the soil that no harm is done to the thistle under field conditions. NaHAsO_3 is ineffective because it penetrates the soil very slowly. A special app. was developed for detg. the rate at which the herbicides penetrate the soil. An application of herbicides in the autumn has no influence on the ammonification and nitrification processes in the soil the following spring. W. H. ROSS

Results at the Pasadena activated-sludge plant (HATCH) 14. The analysis of tomato plants [to determine role of phosphates] (OWEN) 11D. Spectrographic chemical analysis [of Rb in soils and plant ashes] (RAMAGE) 7. S-spray residues and the swelling of tin cans packed with peaches (CULPEPPER, MOON) 12. Mineralogy of soils. I. A detailed study of a region characterized by diverse rocks and partly covered by a glacial drift (HART) 8. Determination of CaC_2 in CaCN_2 (STROHAL) 7. The exchange reaction of insoluble alkaline earth phosphates with permutites and clay (UNGERER) 6. Nature of the nitrogenous compounds in fungous tissue and their decomposition in the soil (HECK) 11D. Pyrethrum flowers [as insecticides] (GNADINGER, CORI) 17.

Tree paint. WALTER G. CORNELIUS. U. S. 1,730,724, Oct. 8. Gilsonite 50 lb., rosin 10 lb., coal tar 10 gal. and gasoline 4 gal.

16—THE FERMENTATION INDUSTRIES

C. N. FREY

Alcoholic fermentation of the amino acids. E. PARISI. *Ann. chim. applicata* 19, 234-9 (1929).—Amino acids occurring in molasses contribute little toward the alc. formed during its fermentation. In solns. contg. 100 mg. of amino N_2 per 100 cc. glycocoll, *d*-alanine, *d*-valine, asparagine, *l*- and *dl*-leucine, *d*- and *dl*-isoleucine, phenyl- α -alanine, phenyl- β -alanine and tryptophan showed consumption of N_2 varying from 20 mg. (tryptophan) to only 2 mg. (phenyl- β -alanine). Therefore, these compds. cannot at present be used as a cheap source of higher ales. A. W. CONTIERI

The noxiousness of methanol formed during alcoholic fermentation. O. WINDHAUSEN. *Naturwissenschaften* 17, 631-4 (1929).—A review. MeOH contents of various natural beverages are given, with references. In certain brandy species as much as 3.2 to 4% of the alc. occurs as MeOH . B. J. C. VAN DER HORVEN

The fermentometer. OTTO RAHN. *J. Bact.* 18, 199-205 (1929). J. T. M.
A new method of making unfermentable cider. S. C. VANDECAVEYE. *Zentr. Bakt. Parasitenk.*, II Abt., 78, 66-74 (1929).—Unfermentable cider can be made by 3 successive inoculations with yeast and the addn. of 0.04% of Na benzoate. The addn. of NH_4 molybdate, Al cream and $\text{Pb}(\text{OAc})_2$ singly or in combination, but not exceeding 0.1%, altered the flavor and was not effective in pptg. P. The addn. of colloids such as agar or silicic acids, of CaCl_2 or of NaCl , singly or combined in 0.1% concn. to cider subjected to 3 successive inoculations with yeast, did not alter the flavor and did not remove any N or P. JOHN T. MYERS

Rapid method for the determination of the dry extract in vinegars. GUIDO DONA. *Giorn. chim. ind. applicata* 11, 264-5 (1929).—The vinegar to be examd. is evapd. to $\frac{1}{2}$ its original vol., and diluted to its original vol. with distd. H_2O . The acidity is detd. Then an AcOH soln. in pure H_2O equal in vol. and titer to the above is prepd. A special hydrometer is then immersed in the AcOH soln. and its scale moved so that its zero pt. is at the liquid meniscus. It is then immersed in the vinegar soln. and the reading taken, the hydrometer having previously been standardized against solns. with known dry ext.

The aims of barley research. H. LLOYD HIND. *J. Inst. Brewing* 35, 69-75 (1929).—The Institute of Brewing Research is directed toward larger yields of best

brewing barley, what constitutes quality in barley, and the changes the barley undergoes in the malting and brewing processes.

The malting barleys of 1928. JAMES STEWART. *J. Inst. Brewing* 35, 116-29 (1929).—Barleys appear to be generally low in N and diastase. Some observations are given on foreign barleys.

Some practical advantages to be derived from the neutralization of brewing liquor. D. McCANDLISH AND G. HAGUES. *J. Inst. Brewing* 35, 61-6 (1929).—A diagram and description are given of an app. for treating the water used in brewing with H_2SO_4 , to bring the water to p_H 7.0. Several years' use of the app. has improved yeast flocculation and the yeast is free from contaminating organisms, although through 200 brews. Before neutralization of the water was practiced, the yeast had to be treated with tartaric acid every 20-30 brews to suppress bacterial infection.

Animal feeding and brewery by-products. C. HEIGHAM. *J. Inst. Brewing* 35, 104-8 (1929).—The brewery by-products wet grains, dried grains, malt culms, dried yeast and spent hops are compared with other feeds in their class, as to dry matter, digestible crude protein, starch equivalent and price.

Inversion method for determining the hydrogen-ion concentration in wine. GEORG AGABALIANZ. *Biochem. Z.* 211, 373-7 (1929).—An improved thermostat for carrying out the H-ion concn. detn. on wine by following the velocity of inversion of a 10% sucrose soln. at 76°. The invertase is inactivated by preliminary heating to 90°. The inversion const. [$K = (\log C_0 - \log C_t)/0.4343.t$] gives accurate information as to the H-ion concn.

The continuous pasteurization of black beers. R. SELIGMAN. *J. Inst. Brewing* 35, 10-7 (1929).

Conditions for the aeration of fermenting vats in the yeast industry or for the aeration of liquids in general. E. G. STICH. *Chem.-Ztg.* 52, 865-6 (1928).—The efficient aeration of liquids is discussed. Important factors are the ratio of the total area of the air passages in the aeration app. to that of the vat floor, and also of the total surface area of the bubbles to the required air content of the liquid.

The nourishment of compressed yeast with inorganic ammonium compounds. WERNER STACH. *Z. angew. Chem.* 42, 842-3 (1929).—A criticism of an article by Claassen (*C. A.* 23, 1210). Reply. H. CLAASSEN. *Ibid* 843.

The cleavage of glycylglycine, alanylglycine and leucylglycine by intestinal and malt peptidases (LINDERSTRØM-LANG, SATO) 11A. Production of absolute alcohol from sulite spirit (KIRMKEUTHER) 23.

Cooling worts during alcoholic fermentation. FRANK E. LICHTENTHAELER. U. S. 1,731,073, Oct. 8. CO_2 evolved during fermentation is drawn off, compressed, cooled and reintroduced.

Denaturing ethyl alcohol. JOHN W. ORELUP, ERNST OHLSSON and SAMUEL ISERMANN. U. S. 1,730,850, Oct. 8. *o*- and *p*-Chlorophenol or other suitable halogen substituent of phenol is used as a denaturant.

Yeast. WILHELM H. F. BÜHRIG (to The Fleischmann Co.). U. S. 1,730,876, Oct. 8. In a "continuous-addn.-withdrawal" process of yeast manuf. yeast is propagated with aeration in a main fermenter while a yeast nutrient soln. is added slowly and substantially continuously, and yeast-contg. soln. is withdrawn at such a rate as approx. equals that of the addn.; the yeast-contg. soln. is conducted to an auxiliary fermenter and propagation of the yeast in the soln. is continued in the auxiliary fermenter with aeration for a period of time after it leaves the main fermenter, and the yeast-contg. liquid is then withdrawn from the auxiliary fermenter and the yeast is sepd. Various preferred and advantageous details of procedure are described. Cf. *C. A.* 22, 3017.

17—PHARMACEUTICAL CHEMISTRY

W. O. EMERY

Determination of phosphorus in Tonophosphan. ANON. *Prog. terap.-Ses. farm.* 17, 50-2 (1928).—In Tonophosphan (Bayer) $Me(Me_2N)C_4H_2PO_3HNa$, P can be detd. by dissolving 0.5 g. sample in 5 cc. water in a Kjeldahl flask, adding 0.5 g. KOH, 20 cc. H_2O_2 (15%) and a few crystals of $Fe(NO_3)_3$, concg. the soln., boiling gently and adding 20 cc. H_2O_2 and 10 cc. HNO_3 (d. 1.4), repeating the concn. and addn. of H_2O_2 , and in the finally concd. soln. detg. phosphoric acid by the NH_4 molybdate method. G. A. B.

Determination of antipyrine in antineuralgic preparations. ANON. *Prog. terap.-Sez. farm.* 18, 12-3(1929).—To 20 cc. of soln. contg. about 0.2% antipyrine (a preliminary test is necessary) add 20 cc. of 2.5% HgCl_2 . Titrate the soln. with alc. 1.35% I soln. until a persistent yellowish color is reached. Titrate the I soln. every time with a standard (1%) pure antipyrine soln. G. A. BRAVO

Solutions of quinine in ethyl urethan. M. GIORDANI. *Ann. chim. applicata* 18, 479-85(1928).—Spectroscopic studies confirmed the conclusion (cf. *C. A.* 22, 4173) that the presence of ethyl urethan in solns. of quinine-HCl accelerates the isomerization of quinine to quinotoxine. A. W. CONTIERI

The thiocyanate number of strophanthus oil and of oils of the chaulmoogra group. E. I. VAN ITALLIE. *Pharm. Weekblad* 66, 677-83(1929).—The SCN ion adds only to 1 of the 2 double bonds in unsatd. acids of the linoleic series, and a comparison of the SCN no. with the I no. makes it possible to calc. the proportions of doubly unsatd., singly unsatd. and satd. acid present in a fat (cf. Kaufmann, *C. A.* 20, 2989). By this method 2 samples of strophanthus oil were estd. to contain 25.2, 26.6% satd. acids, 44.3, 48.1% oleic acid, and 30.5, 25.3% linoleic acid. Chaulmoogra oil and hydnocarpus oil, however, gave I nos. of 100.6 and 95.7, resp., and SCN nos. of 99.1 and 94.8, resp. The close agreement here between I no. and SCN no. precludes the possibility of the presence of more than a trace of any acid of the linoleic series. Similarly, the I no. of gorli oil obtained from seeds of the African tree *Oncoba echinata*, which was formerly believed to contain 10-2% of a highly unsatd. acid, was found to be identical with the SCN no., viz., 93.4 and 93.2, resp., and the absence of linoleic acid was thus demonstrated. A. W. DOX

Microchemical reactions for nicotine. M. WAGENAAR. *Pharm. Weekblad* 66, 773-6(1929).—The lowest concn. and the min. quantity of alkaloid that can be detected by various reactions are: HgCl_2 , 1:100, 0.00001 g.; $\text{KI} + \text{HgI}_2$, 1:500, 0.000002 g.; CdI_2 , 1:1000, 0.000001 g.; CdBr_2 , 1:400, 0.000005 g.; CdCl_2 , 1:100, 0.00002 g.; $\text{Zn}(\text{SCN})_2$, 1:100, 0.00002; $\text{Co}(\text{SCN})_2$, 1:100, 0.00002 g.; PtCl_4 , 1:500, 0.000002; AuCl_3 , 1:500, 0.000002 g.; I in KI, 1:100, 0.00001 g.; picric acid, 1:1000, 0.000001 g.; picrolonic acid, 1:100, 0.000005 g. A. W. DOX

Microchemical reaction for sparteine. M. WAGENAAR. *Pharm. Weekblad* 66, 809-12(1929).—The sensitivity of various pptn. reactions in terms of min. concn. and min. quantity of alkaloid detectable is: CdI_2 , 1:1000, 0.001 mg.; ZnI_2 , 1:1000, 0.001 mg.; SnI_2 , 1:100, 0.01 mg.; AuCl_3 , 1:1000, 0.0005 mg.; $\text{K}_4\text{Fe}(\text{CN})_6$, 1:200, 0.01 mg.; $\text{K}_3\text{Fe}(\text{CN})_6$, 1:200, 0.01 mg.; $\text{KI} + \text{I}$, 1:200, 0.01 mg. A. W. DOX

Rapid determination of ethereal oils in alcoholic solutions. G. ROSENBERGER. *Parfümeur* 3, 78-81(1929).—R. shakes 25 g. of the alc. soln. in a 150 cc. separatory funnel with 25 cc. of a 15% NaCl soln. and 45 cc. petr. ether (sp. gr. 0.63, b. p. below 40°); he distills the aq. salt soln. for the alc. detn. and the petr. ether soln. for essential oils, using Hartel-Witt's method and app. (*C. A.* 2, 1306). P. ESCHER

A new variety of wormwood from the lower Volga which has l-camphor as the principal ingredient of its essential oil. A. RICHTER, L. KASAKEVICH, O. SOBOLEVSKII AND K. SUCHORUKOV. *J. expl. Landwirtschaft Sudosten Europ.-Russlands* 4, No. 2, 10 pp., sep. (1927); *Chem. Zentr.* 1928, II, 193.—A species of *Artemisia* from Astrachan contained 90.87% l-camphor and possessed valuable therapeutic properties. C. R. FELLERS

Detection of isopropyl alcohol in cosmetics by piperonal. G. REIF. *Z. Untersuch. Lebensm.* 57, 277-88(1929).—The alc. distillate from 10 cc. of the sample is cooled in ice water, 1 cc. is added to 3 cc. of an aq. soln. of $\text{HONH}_2 \cdot \text{HCl}$ (0.05 g. for mouth washes and perfumes and 0.1 g. for hair washes), the mixt. shaken, and after 3 min. again shaken with 0.4 g. of animal charcoal and filtered. Five cc. of a 0.5% soln. of piperonal in abs. EtOH, and then 20 cc. of H_2SO_4 are slowly added to the filtrate. In the absence of isopropyl alc. a brown or green-brown color appears, or in its presence a red or red-brown color. If 30 cc. of a 30% soln. of AcOH is at once added, a grayish yellow or transitory red color is obtained in the presence of the alc., or a red-brown color turning red after 10 min. appears in its presence. The method was tested for a no. of cosmetics of known and varied compns., and shown to be independent of the presence of fusel oil, denaturants or other constituents. C. R. FELLERS

Phytomicrochemical tests as pharmacopeial identity tests. E. H. WIRTH AND J. A. DORJAHN. *Am. J. Pharm.* 101, 638-49(1929).—A discussion and preliminary report of certain reliable tests which the authors considered of exceptional value and recommended for the inclusion in the pharmacopeial monographs and also in the National Formulary. Tests are divided into 2 groups: (1) those that depend upon the crystn. of the active constituent, or the identification of the active constituent by the

prepn. of a cryst. compd. by org. chem. reaction, and (2) those where the identity of the isolated constituent is detd. by color reactions. Tests of the following drugs are described: Group I (microcrystn.) cinnamomum, caryophyllus; (microextrn. on a slide) piper, opium, cinchona, myristica and hydrastis; (microsublimation) uva ursi, rheum, cantharis, etc. Group II (color reactions) ipecacuanha, nux vomica, colchicum, hyoscyamus, belladonna and stramonium. Twelve photomicrographs are shown.

W. G. GÄSSLER

The natural chemical resources of Australia plant products. I. A. R. PENFOLD. *J. Chem. Education* 6, 1195-1205(1929).—Australia is especially rich in essential oil-yielding plants, *Eucalyptus* forming 75% of the vegetation. E. H.

The methods of denicotinizing. HANS RUNDSHAGEN. *Chem.-Ztg.* 53, 717-8 (1929).—The extrn. of tobacco with solvents is not satisfactory, as nicotine salts are insol. in most of the solvents, while the aromatic substances are sol. Treatment with alkali destroys the structure of the leaves and the aromatic substances. Direct evapn. of the nicotine has little effect, as its salts are not volatile. Only traces of free nicotine are present in the leaf. If moist leaves are stored in a compact layer, a fermentation occurs, the temp. rises to 60° and NH_3 , HNO_3 , CO_2 and low fatty acids are formed. In a sample, the nicotine content dropped from 1.75 to 0.05%. A study of the biol. conditions of the bacteria of tobacco fermentation is recommended. A. E. M.

Fluidextract of *Frangula*. CHR. SCHOUSEN. *Dansk. Tids. Farm.* 3, 209-22 (1929).—S. discusses the methods for extg. the active principle of *Frangula* as recommended by different pharmacopoeias. The relative solubilities of the different compds. found in this plant in water, alc., etc., are also considered. A method of analysis is also discussed. Percolating with a 4 to 1 alc.-water mixt. yielded a fluidext. contg. the active principle of *Frangula*. The results agree well with those of Aweng who used 80-90% alc. soln. for extrn. O. A. NELSON

Titration of some mercury preparations used in pharmacy. ALFRED WÖHLK. *Dansk. Tids. Farm.* 3, 225-44(1929).—Numerous methods for the detn. of Hg compds. are discussed. For HgCl_2 : To 20 cc. HgCl_2 soln. (not less than 1%), add 0.5-1.0 cc. H_2O_2 (3%), 5 cc. dil. H_2SO_4 and 3-5 cc. starch soln. With const. shaking add 0.1 N KI soln. until the red HgI_2 changes over to a brick red. The color of the soln. now becomes faintly blue. Back titration cannot be done, although one can add a drop of $\text{Na}_2\text{S}_2\text{O}_3$ soln., whereby the color again turns brick red; thus it is ascertained that an end point is reached. For HgO : Dissolve HgO in about 10 times its weight of $\text{Na}_2\text{S}_2\text{O}_3$ soln. The temp. must not rise over 35-38°. Two mols. NaOH are liberated per 1 mol. HgO . Titrate with 0.1 N acid. For calomel: $\text{Na}_2\text{S}_2\text{O}_3$ ppts. Hg from HgCl_2 . Carefully wash the gray Hg and then shake with 0.1 N I_2 soln. Titrate the excess I_2 soln. with $\text{Na}_2\text{S}_2\text{O}_3$. HgCN , $\text{Hg}(\text{CN})_2$, and Hg salves are also considered. O. A. N.

Birch oil. R. HUERRE. *Cuir tech.* 18, 231-2(1929).—Samples of birch oil obtained differed widely. Birch oil made from bark in the lab. had an almost const. compn. A yield of 7-8.4% based upon the wt. of the bark was obtained. At atm. pressure 4% of the birch oil distd. over at less than 100°, 38% from 100° to 150°, 15% from 150° to 250° and 14% from 250° to 300°. Further heating caused decompn. The sp. gr. was 0.985. J. G. NIEDERCORN

A new essential oil containing geraniol. B. N. RUTOVSKII AND N. MAKAROVA-SEMLYANSKA. *Riechstoffind.* 3, 140, 161(1928); *Chimie & industrie* 22, 323.—The yield of oil obtained by steam distn. of *Laserpitium hispidum* MB, harvested in Crimea, varied from 0.18 to 0.77% according to the part of the plant that was distd. and to its dryness. Samples taken periodically during the distn. showed that the content of alcs. progressively increased. The oil contains monocyclic and aliphatic terpenes, which could not be identified, and 40-2% geraniol. A. PAPINEAU-COUTURE

Cod-liver oil with ferrous iodide. V. ZANOTTI. *Boll. chim.-farm.* 48, 543-4 (1929); cf. Siboni, C. A. 23, 3542.—A formula is given for the prepn. of cod-liver oil contg. Fe and I. G. SCHWOCH

Medicinal plants and the Italian Pharmacopeia. C. B. INVERNI. *Giorn. farm. chim.* 78, 355-6, 359-60, 363-4, 367-8(1929). G. SCHWOCH

Presence of *l*-asparagine in the fresh flowers of *Ulex europaeus* L. M. BRIDEL. *J. pharm. chim.* [8], 9, 112-3(1929).—See C. A. 23, 4719. S. WALDBOTT

Study of the complex digitonin-ergosterol. H. PÉNAU AND (MLLE.) Z. HARDY. *J. pharm. chim.* [8], 9, 145-51(1929).—For complete pptn. of ergosterol (A) by means of soln. of digitonin (B), dissolve 175 mg. of A in 99% warm EtOH, cool and bring the vol. to 100 cc. at 15°. Also prep. a 1% soln. of B in 99% EtOH at 15°. Then put into a dry and tared centrifuge tube 10 cc. of soln. A at 15°, 9 cc. of soln. B at 15° and 2 cc. H_2O . Mix well with a glass rod, then rinse it with 5-6 drops of 99% EtOH, and

allow the mixt. to stand at 18° for 18 hrs. Centrifuge for 15 min., decant the liquid from the ppt., wash the latter with 4 cc. of Caminade's solvent (C. A. 17, 1257), then mix it with 3 cc. of the same solvent, rinse the rod with 1 cc. of solvent, again centrifuge, decant and put the tube with the ppt. into a vacuum over P_2O_5 to const. wt., i. e., for 18 to 24 hrs. From 0.0175 g. A, 0.07 g. (± 0.5 mg.) of the complex was obtained, i. e., 1 g. of the complex contains an av. of 0.250 g. A. S. WALDBOTT

Detection of carbon tetrachloride in chloroform. J. SIVADJIAN. *J. pharm. chim.* [8], 9, 434-7(1929).—Shake 1 g. of the suspected $CHCl_3$ with 250 cc. of a satd. aq. soln. of CCl_4 ; any insol. liquid residue indicates the presence of at least 5% of CCl_4 in $CHCl_3$. This test is a proposed correction of the faulty test of the French Codex. A new color test (cf. C. A. 17, 2575; 19, 649) is as follows: Into about 5 cc. of an alc. 1% soln. of pyrocatechol pour 2 cc. $CHCl_3$, and 0.5 cc. NaOH carefully as a substratum. Add a pinch of powd. Cu, rapidly bring to boiling and maintain this for 8-10 sec. Cool rapidly, add 1 cc. concd. HCl and 1 cc. H_2O , agitate, then decant and filter about half the vol. When the $CHCl_3$ contains 0.25% CCl_4 or less, the liquid will be straw-yellow to brown-yellow; with 0.25-0.50% CCl_4 an orange-yellow, above 0.50% a more or less dark purple red color is obtained. Pure $CHCl_3$ does not produce any color in this test. $CHCl_3$ for anesthetic purposes should not contain more than 0.25% CCl_4 . S. WALDBOTT

Preparation of gentianose from gentian root dried in air without fermentation. M. BRIDEL AND (Mlle) M. DESMAREST. *J. pharm. chim.* [8], 9, 465-79(1929).—The process of rapid percolation (C. A. 22, 3019) is applied to powd. gentian previously dried in air without fermentation, and rich in gentianose (A) (24%). Cold percolation with 90% alc. (collecting 10 vols. of percolate) extd 95.95% of A present; percolation with 95% alc. (collecting 20 vols.) extd. 36.5%, although A is but feebly sol. in 90% and nearly insol. in 95% alc. The solns. obtained are supersatd. and soon ppt. A in crystd. form. This behavior is probably caused by the presence in the root of some unstable complex more sol. in alc. than A itself. By means of this process, 50 g. of A per kg. of powd. dried root may be easily extd. The results also confirm the preservation of immediate principles in the fresh root through proper drying as advocated by Bourquelot and B. (C. A. 4, 2977). A list of 12 references is added. S. W.

Chemical composition of the root of Geum urbanum L. J. CHEYMOL. *Schweiz. Apoth.-Ztg.* 66, 283-4(1928); *Thesis*, Paris, 1927; cf. C. A. 19, 1442; 20, 435; 21, 1126. —A study of geoside and gease. On drying the root, the geoside upon hydrolysis disappears completely, as the resulting eugenol (A) evaps. C. det. A by oxidation with $FeCl_3$, insol. dehydrodieugenol being formed (cf. C. A. 2, 2825, 3349). Good results are obtained with quantities of A above 0.1-0.02 g. Certain allied plants in which gease occurs are enumerated. S. WALDBOTT

Color reaction differentiating between sodium benzoate from synthetic benzoic acid and that made from gum benzoin. A. B. *Schweiz. Apoth.-Ztg.* 67, 110(1929).—Pharm. Helv. requires the $BzOH$ for this salt to be derived from the gum. Dissolve 0.15 g. of the salt in 15 cc. H_2O , add 10 drops HCl and shake; flaky $BzOH$ ppts. Add 10 drops $K_2Cr_2O_7$ and later 5 drops $FeCl_3$. When the reaction has ceased, add 5 drops dil. HCl and 5 drops H_2O_2 . A blue color is seen, changing to green, then to yellowish green. Further addn. of 5 drops dil. HCl produces yellow, then addn. of 5 drops H_2O_2 forms blue, then bluish green, finally colorless (from synthetic $BzOH$); faintly yellow to colorless ($BzOH$ from gum). After several hrs. the soln. contg. the synthetic $BzOH$ has a violet tint. The use of a const. drop size app. is essential. S. W.

Ammonium salt of acetylsalicylic acid. M. N. DVORNIKOFF. *J. Am. Pharm. Assoc.* 18, 213(1929).—Following Woldman's procedure for making the NH_4 salt of acetylsalicylic acid (C. A. 23, 1215) D. obtained impure acetylsalicylic acid and not its NH_4 salt. Acetylsalicylic acid dissolves in NH_4OH to form the NH_4 salt. Excess acid dissolves in the warmed soln. and seps. on cooling. L. E. WARREN

The seeds of Monarda punctata. A. A. HARWOOD. *J. Am. Pharm. Assoc.* 18, 228-31(1929).—The seed contained moisture 3.6, ash 7.51, benzine ext. 28.3 and fixed oil 22.6%. The oil had d_{25} 0.9100, sapon. no. 173.3 and I no. 207.4. Thymol was absent; oleic acid was present. L. E. WARREN

The estimation of alkaloids in admixture with vegetable drugs. GEORGE E. ÉWE. *J. Am. Pharm. Assoc.* 18, 241-3(1929).—Extractives were shaken out from rhubarb, gentian, podophyllum, capsicum, cannabis and jalap, as well as tannic acid, with ammoniacal $CHCl_3$; aliquot portions of the soln. were evapd. and the residue was titrated with standard acid as in alkaloidal detns. In each case, except rhubarb and tannic acid, some acid was consumed. If alkaloids had been present the results would have been high. The expts. were repeated with the addn. of known amts. of strychnine followed by purification by the double shake-out procedure. The results indicated

almost complete recovery. The exact nature of the basic substance causing the apparent high alkaloidal results in the unpurified exts. was not ascertained.

L. E. WARREN

A pharmacognostic study of ch'an su, the dried venom of the chinese toad. K. K. CHEN AND H. JENSEN. *J. Am. Pharm. Assoc.* 18, 244-51(1929).—The species which had furnished the venom could not be detd. No definite cellular elements could be seen under the microscope. Moisture was 5.04, ash 3.10, volatile material 1.09%; cholesterol m. 146°, bufagin m. 217°, an unidentified N compd. m. 200° and epinephrine m. 212° were identified.

L. E. WARREN

An improvised nitrometer for the assay of spirit of ethyl nitrite. C. L. COX. *J. Am. Pharm. Assoc.* 18, 260-1(1929).

L. E. WARREN

Phytopharmacological examination of adrenaline and ephedrine. DAVID I. MACHT. *J. Am. Pharm. Assoc.* 18, 335-7(1929).—The effect of adrenaline and ephedrine on the growth of lupine seedlings was studied. Adrenaline was very toxic; ephedrine was only slightly so. Solns. of adrenaline may be evaluated by the method.

L. E. WARREN

A pharmaceutical study of magma magnesiae, 1900-1930. A. J. LEHMAN. *J. Am. Pharm. Assoc.* 18, 261-5, 391-5, 482-6(1929).—Historical review.

L. E. WARREN

Sirup of ferrous iodide and the official hydriodic preparations. H. V. ARNY, BENJAMIN VENER AND LESLIE C. JAYNE. *J. Am. Pharm. Assoc.* 18, 265-8, 384-91(1929). Sirup of FeI_2 and the other HI preps. of the U. S. P. X. were made according to the U. S. P. and with certain modifications. The preps. were kept under various conditions of storage and were examd. at intervals with respect to color, appearance and chem. analysis. The U. S. P. sirup of HI is satisfactory. The U. S. P. sirup of FeI_2 turns yellow and shows traces of ppt. In such deterioration I does not decrease negligibly. The turbidity or "scum," which sometimes forms in the sirup of FeI_2 , is $\text{Fe}(\text{PO}_3)_3$. Exposure to sunlight tends to prevent the formation of the scum. The sirup sets I free in absence of a stabilizer. Exposure to sunlight brings the free I into combination again. The U. S. P. sirup contg. free HPO_2 decomposed more than the others. However, the omission of the HPO_2 and $\text{C}_3\text{H}_5(\text{OH})_3$ as a stabilizer gave less satisfactory products. A specimen of sirup of FeI_2 made with invert sugar kept perfectly for 22 months.

L. E. WARREN

Studies in bio-assays. "The strophanthins and ouabain." C. W. EDMUNDS, H. W. LOVELL AND S. BRADEN. *J. Am. Pharm. Assoc.* 18, 338-44(1929).—Four specimens of ouabain and 5 of strophanthin were obtained from various sources. All were subjected to well-known methods of assay by 2 observers working almost independently. Strophanthin is found on the market in 2 forms, one being about twice as strong as the other. Therefore, the U. S. P. should state the physiol. activity of the product described. The ouabain on the market appears to be of uniform activity and about twice as strong as strophanthin.

L. E. WARREN

The non-heptane constituents of Jeffrey pine oil. P. A. FOOTE. *J. Am. Pharm. Assoc.* 18, 350-3(1929).—The chief constituent of the oil from Jeffrey pine is n-heptane. The non-heptane fractions from a large amt of the oil were obtained by fractionation above the b. p. of heptane. The aldehydes were removed by the usual sulfite process and were fractionated at 0.1 mm. into 50 fractions of 1° each. The b. ps. and ds. of the fractions are recorded. In some of the distillates n-octylic, n-nonylic and n-decylic aldehydes were identified.

L. E. WARREN

Book literature on new remedies. LIDA WINKELBLECK AND EDWARD KREMMERS. *J. Am. Pharm. Assoc.* 18, 354-6(1929).—Bibliography.

L. E. WARREN

Australian sandalwood oil compared with the official. EDWARD SWALLOW. *J. Am. Pharm. Assoc.* 18, 684-6(1929).—The U. S. P. sandalwood oil is obtained from *Santalum album* and must contain not less than 90% of alcs. as santalol. Australian sandalwood oil is obtained from *S. spicatum*. It contains 90-94% of santalol. Clinicians report that the Australian oil is equal in therapeutic efficiency to U. S. P. oil. It should receive recognition in U. S. P.

L. E. WARREN

A preliminary study on the standardization and stabilization of mydriatics and myotics. E. E. SWANSON, H. E. THOMPSON AND C. L. ROSE. *J. Am. Pharm. Assoc.* 18, 446-50(1929).—The cat-eye method of Munch (*C. A.* 21, 3423) was submitted to several collaborators. The alkaloids (or their salts) studied were atropine, ephedrine, hyoscyamine, pseudoeuphadrine, scopolamine, homatropine, pilocarpine, physostigmine and arcoline. Not all cats have the same threshold dose for the mydriatic drugs. The av. findings agree with values reported by Munch. Five tinctures of belladonna were tested. The results do not agree with the chem. assay; probably this is due to the variable proportions of scopolamine and hyoscyamine in the tincture, the mydriatic

values of the 2 alkaloids not being the same. The min. effective concn. found for pilocarpine and arecoline did not agree with the values found by Munch. L. E. W.

The buffer capacities of acacia and tragacanth. J. C. KRANTZ, JR. *J. Am. Pharm. Assoc.* 18, 469-73(1929).—Emulsions of cottonseed oil and mineral oil were prepd. with acacia and tragacanth in H_2O . Changes in p_H were produced by the addn. of NaOH or HCl. The most stable range for acacia emulsions lies between p_H 2 and 10.5 and for tragacanth between 1.9 and 2.3. Diln. with H_2O has but little influence on the p_H of acacia solns. Conclusions: The buffering effect of acacia on the acid or alkali added to the emulsions influences the stability of the emulsion. The buffering effect of tragacanth does not play as important a role in the stability of the emulsions as does acacia. L. E. WARREN

A new dihydroterpene. SIMON BLANCO. *J. Am. Pharm. Assoc.* 18, 474-7(1929).—A volatile oil was obtained from the seeds of *Ptilosporum pentlandrum* grown in the Philippine Islands. The following results were obtained: $d_{20} 0.7692$; $n_D^{25} 1.435$; $[\alpha]_D^{25} +20.0^\circ$; sapon. no. 0.67. The oil was fractionated, and from the $152-3^\circ$ portion a nitrobenzylamide was prepd., m. 146° L. E. WARREN

Abbreviations in the pharmacopeia X and in the National Formulary V. CHARLES C. PLITT. *J. Am. Pharm. Assoc.* 18, 487-90(1929).—A plea is made for uniformity. L. E. WARREN

Comparative chemical examination of different brands of acriflavine hydrochloride (acriflavine) and acriflavine base (neutral acriflavine). GEO. W. COLLINS AND ARANKA STASIAK. *J. Am. Pharm. Assoc.* 18, 659-69(1929).—Specimens of acriflavine and neutral acriflavine of domestic and foreign makes were examd for ash, H_2O -insol., loss over H_2SO_4 , loss at 100° , Cl content, N content and HCl content. No justification was found for the claim that foreign brands were of higher degree of purity than domestic. Acriflavine should be called "acriflavine hydrochloride." The amt. of H_2O is so variable that a formula giving 1 mol. of H_2O is not warranted. The appearance of several specimens of neutral acriflavine varied considerably. H_2O of crystn. is not present. Several brands contained considerable amts. of NaCl. The product should be called "acriflavine base." L. E. WARREN

Assay of ground flaxseed for non-volatile, ether-soluble extractive. JOSEPH L. MAYER. *J. Am. Pharm. Assoc.* 18, 683-4(1929).—In an attempt to shorten the U. S. P. method M. macerated specimens of the drug for 2 months with Et_2O , washed the material with the solvent, filtered the soln. and evapd. the residue. The 2 expt gave 30.5 and 30.6%, resp. With a Soxhlet app and the U. S. P. method the findings were 37.0 and 37.0%, resp. These tests indicate that the short method is unworkable. L. E. WARREN

Observations on the U. S. P. X. Test for Foreign Gums in Tragacanth. R. A. KONNERTH. *J. Am. Pharm. Assoc.* 18, 698(1929).—It was noted that after about Feb., 1928, no tragacanth appeared on the market which would conform to the U. S. P. X. $Na_2B_4O_7$ test. Every specimen gave a solid gel with this test (indicative of foreign gum). The specimens were of very fine appearance. The test should be revised or eliminated from the U. S. P. X. L. E. WARREN

Some notes on the U. S. P. sodium borate test for tragacanth. EARL B. FISCHER. *J. Am. Pharm. Assoc.* 18, 889-91(1929); cf. preceding abstract.—Specimens of tragacanth were rejected by dealers who reported that the drug did not respond satisfactorily to the U. S. P. $Na_2B_4O_7$ test. Since the products were of good appearance, investigation was started. Tests showed that too much $Na_2B_4O_7 \cdot 10H_2O$ is directed to be used. The proper amt. appears to be 0.6 g. instead of 2.0 g. L. E. WARREN

Solubility determination of U. S. P. chemicals. WOLFGANG SCHNELLBACH AND JOSEPH ROSIN. *J. Am. Pharm. Assoc.* 18, 762-71(1929).—The solubilities of $MgSO_4 \cdot 7H_2O$ in H_2O and in $C_2H_5(OH)$, at 25° were detd. The soly. in H_2O was detd. by weighing the residue on evapn., detg. the Mg and detg. the SO_4 . One g. of $MgSO_4 \cdot 7H_2O$ is sol. in 0.835 cc. H_2O , and 100 g. satd. soln. contains 54.57 g. of the salt. In the $C_2H_5(OH)$ test the Mg and the SO_4 were detd. One g. of $MgSO_4 \cdot 7H_2O$ is sol. in 1.08 cc of glycerol, and 100 g. of a satd. soln. contains 42.56 g. of the salt. The tendency of $MgSO_4 \cdot 7H_2O$ to retain its H_2O is greater than the tendency of $C_2H_5(OH)$ to absorb H_2O from the H_2O content of the salt. L. E. WARREN

Pyrethrum flowers. I. The quantitative determination of the active principles. C. B. GNADINGER AND C. S. CORL. *J. Am. Chem. Soc.* 51, 3054-64(1929).—Pyrethrin I and II have been isolated from Japanese *Pyrethrum* flowers; their action on alk. Cu soln. has been investigated and a table is given showing the wts. of pyrethrin I equiv. to amts. of dextrose from 0.750 to 2.875 mg. Based upon these values a method has

been described for detg. the % of active principles in *Pyrethrum* flowers. The % of pyrethrins ranged from 0.40 to 1.21% in the 16 samples of flowers examd.; the stems contain about 0.1 the amt. of pyrethrins found in the poorest flowers. Daisy flowers contain no pyrethrins. The active principles of Japanese *Pyrethrum* are the same as those of Dalmatian *Pyrethrum* flowers. The toxicity of the pyrethrins to cockroaches has been detd. The pure pyrethrins were extremely toxic to these insects.

C. J. WEST

Cr plating [for pharmacy utensils] (GUIDINI) 4. Monobromoguaiacol carbonate (CHERNOFF) 10. Derivatives of dihydrocodeinone and its substitution products (U. S. pat. 1,731,152) 10.

Curing tobacco. WALTER F. LILIENFIELD (to Lilienfield Bros.). U. S. 1,731,018, Oct. 8. In order to render mild and to cure strong tobacco, previously aged and fermented tobacco leaves are loosened and are subjected to a "machine created" ultra-violet ray for 15 min. to 2 hrs. to give them the desired mildness.

18—ACIDS, ALKALIES, SALTS AND SUNDRIES

E. M. SYMMES

The preparation of hydrazoic acid and its salts. W. HOTH AND G. PYL. *Z. angew. Chem.* 42, 888-91 (1929).—Alkali and alk. earth azides can be prepd. easily and safely by distn. under reduced pressure of HN_3 from NaN_3 and H_2SO_4 . Aq. solns. of HN_3 can be made from NaN_3 by decompn. with H_2SiF_6 or oxalic acid, and BaN_3 prepd. therefrom. BaN_3 and H_2SO_4 make pure, aq. HN_3 . Conditions for prepn. of KNH_2 and KN_3 by the Wislicenus method are given. KN_3 and $\text{Ba}(\text{ClO}_4)_2$ give BaN_3 very easily, and it can also be prepd. at a 30% yield from EtNO_2 , $(\text{NH}_4)_2$ and $\text{Ba}(\text{OH})_2$. LiN_3 can be made by decompn. of NaN_3 and LiCl in aq. alc. soln. E. M. S.

Sulfuric acid. A. O. JAEGER. *Chemicals* 32, 29-31 (1929).—See C. A. 23, 4301.

F. M. SYMMES

Problems of chemical economy in the nitrogen industry. H. GROSSMANN *Chem.-Ztg.* 53, 661-3 (1929).—A general review; illustrated. E. M. SYMMES

Preparation of alkali metal cyanides from their carbonates, carbon and nitrogen. N. A. FLEISHER *Trans. State Inst. Applied Chem. (Moscow)* No. 10, 5-27 (1928).—The literature and patents on prepn. of alkali cyanides from mixts. of alkali carbonates and C, acted upon with N gas at high temp., are shown. In actual tests the catalysts used were (I) powd. Fe (Ferrum alkoholisatum), (II) Fe obtained by reduction of $\text{Fe}_2\text{C}_2\text{O}_4$ with com. H, (III) the same, reduced with electrolytic H, (IV) the same, reduced with H obtained from Al and KOH soln. (V) freshly prepd. FeC_2O_4 from $\text{H}_2\text{C}_2\text{O}_4$ and FeSO_4 , (VI) $\text{H}_2\text{C}_2\text{O}_4$ and FeCl_2 . A wet mixt. of Na_2CO_3 1, charcoal (70.7% C) 0.7, Fe 0.17 was made into briquets, dried and heated in an Fe tube while passing through N under pressure at a rate of 1 l. per hr. Briquetting improves the NaCN yield, whereas the grade of Fe, the proportions and time of heating do not. The use of metallic Fe, not Fe salts, is essential. Moisture is detrimental. Addn. of metallic Mn (Ger. pat. 176,080) is superfluous. The best yield, 58% NaCN, was with II on heating at 990° for 1.5 hrs. When K_2CO_3 1.3, charcoal 0.7 and Fe 0.17 are treated as above, results show that the KCN yield is affected by the degree of coarseness of the Fe. The best yield, 55% KCN, was obtained with II on heating at 990° for 2.75 hrs. The same expts. under atm. pressure gave better yields, with Na_2CO_3 64% on heating at 1010° for 2 hrs. with I and K_4FeCN_6 , and in the case of K_2CO_3 the coarseness of the Fe had no effect and best yields (68%) were obtained with powd. cast Fe at 1010° for 2.5 hrs. and with a mixt. of VI and K_4FeCN_6 73% yield at 1030° for 2 hrs. K_4FeCN_6 alone gave practically negative results. K_2CO_3 gave the best yield, 74%, with IV at 1040° for 1.75 hrs. K_2SO_4 , with which com. K_2CO_3 is contaminated, has a decidedly detrimental effect on KCN yields. CHAS. BLANC

The Brazilian salt works; its technic and economy. FRD. W. FREISE. *Kali* 23, 264-6 (1929).

E. M. SYMMES

Material handling as applied to nitrate. STERLING H. BUNNELL. *Iron Age* 124, 667-70 (1929); cf. C. A. 22, 1656.

E. M. SYMMES

Preparation of barium chloride from wastes of the production of lithopone. F. N. STROKOV. *Trans. State Inst. Applied Chem. (Moscow)* No. 10, 28-35 (1928).—The solid residue left after leaching BaS from the fusion of heavy spar with C contains Ba-

SiO_2 and BaCO_3 , which are converted into colorless BaCl_2 by treating with HCl , evapg. to dryness, igniting for 1 hr. with a free gas flame, dissolving in H_2O , filtering, crystg. from CaCl_2 , filtering and drying in air. Analysis: BaCl_2 85.16, H_2O 14.93, CaCl_2 traces, Fe and SiO_2 none. CHAS. BLANC

Conversion of barium sulfide to barium chloride by the action of chlorine. F. N. STROKOV. *Trans. State Inst. Applied Chem.* (Moscow) No. 10, 36-56 (1928).—The work was undertaken to det. yields and essential conditions of proposed methods of prepn. of BaCl_2 from BaS by the action of Cl gas (U. S. 1,167,061). BaS was chlorinated by both wet and dry methods. The crude BaS was made from barite by reduction with C in lithopone manuf. In the wet process it was leached with hot H_2O , with hydrolysis of BaS to Ba(OH)_2 and Ba(SH)_2 . On cooling most of the Ba(OH)_2 and some Ba(SH)_2 pptd. In preliminary tests cold BaS solns. were filtered from Ba(OH)_2 and chlorinated, since it was found that vigorous and prolonged passage of Cl tends to excessive formation of BaSO_4 , rapid passage of Cl increases formation of BaSO_4 , chlorination to room temp. requires greater time and gives more BaSO_4 . 100 g. of com. BaS were extd. by boiling with 400 cc. H_2O , the hot BaS soln. was filtered from insol., heated to $85-90^\circ$ and treated with Cl until the soln. became milky, the temp. being maintained by the heat of reaction. The S ppt. was filtered off and the filtrate, contg. BaCl_2 , crystd. with yields of 95% BaCl_2 and 90% S , 27% of which is BaSO_4 . Of the Cl used, 80-94% reacted, depending upon the concn. of the BaS soln. The best results were obtained at concns. of 160-270 g. per l. BaCl_2 so obtained contained BaCl_2 84.82, H_2O 15.01, $\text{H}_2\text{O-insol.}$ 0.02 and no Ca or Fe salts. In the dry process preliminary results showed practically no BaCl_2 formation on passing dry Cl over BaS at $18-28^\circ$, but reaction began at above 60° , rose exothermically to 200° , and was maintained at $90-100^\circ$ by regulating the flow of Cl . This step was characterized by depositing S . The temp. then dropped, regardless of the amt. of Cl fed in. The mass was heated by a flame to 120° , and reaction continued with distn. of S_2Cl_2 , the temp. rising spontaneously about 200° . Conversion was complete in about 3 hrs., toward the end becoming slow and requiring a large excess of Cl , because Ba polysulfides are decompd. with difficulty. The mass was washed with C_6H_6 to remove S_2Cl_2 , dissolved in hot H_2O , filtered and crystd. Over 70% S_2Cl_2 was recoverable. Complete conversion of BaS to BaCl_2 is practicable by this method. For economy, chlorination may not be forced to the end until all the BaS and BaS_3 are decompd., giving a yield of 98.5% BaCl_2 . The wet method has the greater com. feasibility. CHAS. BLANC

Manufacture of potassium chlorate by double decomposition. C. MAZZETTI. *Ann. chim. applicata* 19, 273-82 (1929).—From a study of the equilibria $\text{KCl-KClO}_3\text{-H}_2\text{O}$, $\text{CaCl}_2\text{-Ca(ClO}_3)_2\text{-H}_2\text{O}$, $\text{KClO}_3\text{-Ca(ClO}_3)_2\text{-H}_2\text{O}$ and $\text{KCl-CaCl}_2\text{-H}_2\text{O}$, the old Liebig method of manuf. of KClO_3 from $\text{Ca(ClO}_3)_2 + \text{KCl}$ might be revived. From a study of the above isotherms the best conditions for optimum yield can be detd. A. W. CONTIERI

Gypsum: Its uses and preparation. R. M. SANTMYERS. *Bur. Mines, Circ.* 6163, 28 pp. (1929).—Eight primary and 6 manufactured uses of gypsum are discussed. One of these uses is application to cement, 9 types of which are mentioned. ALDEN H. EMERY

Development of the domestic gypsum industry, by states. R. M. SANTMYERS. *Bur. Mines, Circ.* 6173, 44 pp. (1929); cf. *C. A.* 23, 5278. ALDEN H. EMERY

The Haglund method of manufacturing alumina. ASSAR GRÖNWALL. *Teknisk Tid. Kemi* 59, 93-6 (1929).—Impurities in bauxite are removed by addn. of sulfide contg. materials and reducing in an elec. furnace. Pure Al_2O_3 crystallizes on cooling. The slag contains all foreign metals and some Al_2S_3 , which is later decomposed with H_2O to regain Al_2O_3 . This method is more economical than all older methods, and can be applied to bauxite contg. more SiO_2 than can be allowed in these. One ton of Al_2O_3 requires 4500 kw.-hrs. The furnace is lined with square C electrodes, which are not corroded by Al_2S_3 . Water-cooled Cu pipes are used for elec. conductors. G. R.

Preparation of pure alumina from Tikhvin bauxites. I. LILIEV. *Trans. State Inst. Applied Chem.* (Moscow) 1927, No. 8, 14-38.—Three samples of Tikhvin bauxite contained (I) 17.4, 40.6, 23.5; (II) 7.6, 63.5, 14.0; (III) 5.0, 74.5, 5.7 of SiO_2 , Al_2O_3 and Fe_2O_3 , resp. Al_2O_3 used for the manuf. of Al should not contain over 0.3% SiO_2 and 0.1% Fe_2O_3 . Methods of purification were investigated. Packard's process (Ger. pat. 182,444) gave very good results with I. Up to 90% Al_2O_3 was extd. and the unused Na_2CO_3 was only 4%. This process is inapplicable to II and III, which have a greater Al_2O_3 content, because the reactions do not take place according to the equations given by Packard, but are $\text{Na}_2\text{CO}_3 + \text{Al}_2\text{O}_3 = 2\text{NaAlO}_2 + \text{CO}_2$; $\text{Fe}_2\text{O}_3 + \text{Na}_2\text{CO}_3 = 2\text{NaFeO}_2 + \text{CO}_2$. At $800-900^\circ$ CaO reacts with SiO_2 and kaolin reacts with Na_2CO_3 .

to form an insol. aluminosilicate, only 12% of the kaolin decomposing into Na_2SiO_3 - NaAlO_2 and dissolving in H_2O . To obtain good results with these reactions it is necessary to use 1 mol. Na_2CO_3 per mol. Al_2O_3 and 1 mol. Na_2CO_3 per mol. Fe_2O_3 . Also, the ratio between Na_2CO_3 and CaCO_3 should be about 1.5:2. It is important that all ingredients be well ground and thoroughly mixed, then calcined at $875\text{--}925^\circ$ in an oxidizing atm., so that the Na_2CO_3 reacts completely with Al_2O_3 and to only a slight extent with kaolin. Unless calcination is done in such an atm. Fe and Cr oxides form, contaminating the aluminates. Washing with H_2O must be done at 90° , as at ordinary temp. a large amt. of SiO_2 compds. dissolve. Filtration of the alk. soln. gives no trouble. To sep. cryst. $\text{Al}(\text{OH})_3$ fractional pptn. may be used. The soln. must be 35° Bé. and $60\text{--}90^\circ$. The 3 fractions contain up to 0.1%, up to 0.3% and above 0.3% SiO_2 , resp. The remaining soln. solidifies and can be re-used as Na_2CO_3 . Under the above conditions 85–90% of the Al_2O_3 is extd. from the bauxites. **BERNARD NELSON**

Vanadium and some of its industrial applications. **JEROME ALEXANDER.** *Chemistry and Industry* 48, 871–8, 895 901(1929).—An account of the history and chem. relations of V, with its uses as catalyst, in metallurgy, pharmacy and therapeutics, ink, dryer, insecticide, fungicide, "fertiliser," purification of HCl, photography and glass. Bibliography. **W. C. EBAUGH**

Adhesives of vegetable origin. **HANS J. BRAUN.** *Metallbörse* 19, 2025, 2080–1 (1929).—Typical of a vegetable adhesive or sizing is that made from potatoes, thus: 100 kg. of potato starch is mixed with 300 l. cold H_2O to form a milky liquid, 24 kg. of soda soln. (36 38° Bé.) dild. with 5 kg. H_2O is added gradually, and stirring continued. The mass thickens, and 120 kg. of H_2O is added gradually. When clear the product is sterilized with Hg cyanide or β -naphthol, grotan, etc. For some purposes the alkali present is objectionable, so it is neutralized, in whole or in part, with HCl or HNO_3 , giving a paste with less adhesive strength. These acids may be replaced in part by H_3PO_4 , yielding an adhesive less likely to cause rust. Special treatments for particular kinds of adhesives are outlined. **W. C. EBAUGH**

Asbestos for chemical purposes. **E. VISLENEVA.** *Trans. State Inst. Applied Chem. (Moscow)* No. 8, 60 73(1927).—Asbestos suitable for use in Gooch crucibles, catalyzer support in H_2SO_4 manuf. and other chem. purposes was sought in Russia. Four samples were found and compared with Kahlbaum's crucible grade. Two were as good, but the mines have not been investigated geologically. Exploitation is difficult on account of the distance from railroads. One sample was too brittle, and another too unstable in HCl. An attempt to use serpentine asbestos, or the SiO_2 skeleton obtained after HCl treatment, showed that the substance was too hygroscopic to weigh. A detailed examn. of various species of asbestos is given. **BERNARD NELSON**

Structure and analysis of bleaching earths. **L. KALUSKY.** *Seifensieder-Ztg.* 56, 318(1929). K.'s published conclusions (*C. A.* 23, 3054) are based on original work; the samples were the fresh earths of commerce; the crude earths represented av. samples weighing 15 tons. Properly purified earths do not age easily, but earths with added peroxides, etc., age readily. **P. ESCHER**

Casein. **CH. PORCHER.** *Proc. 8th World's Dairy Congress* 1928, 800–10; cf. *C. A.* 22, 3672.—A review. **A. PAPINEAU-COUTURE**

The discoloration of commercial casein. **OTAKAR LAXA.** *Proc. 8th World's Dairy Congress* 1928, 810–11.—The discoloration on heating to 100° or over of certain caseins used for making artificial horn is shown to be due to the presence of amino acids (originating either from the use of partially decomposed milk for the manuf. of the casein, or from decompn. of the latter through its being kept moist). To prevent discoloration, they should be eliminated by washing with cold water. **A. PAPINEAU-COUTURE**

Carbon tetrachloride as a fire-extinguishing agent. **F. WIRTH.** *Chem.-Ztg.* 53, 651 2(1929).—Data from reports on the formation of COCl_2 from CCl_4 indicate that it is readily possible to have COCl_2 present in harmful quantities when CCl_4 is used as a fire extinguisher, but that with air currents removing it from the scene of action such dangers are minimized. For perfect safety gas masks provided with agents to protect against COCl_2 are recommended. **W. C. EBAUGH**

Heat economy in the lime kiln. **FR. LIPINSKI.** *Tonind.-Ztg.* 53, 1286–8(1929).—The heat balance for the lime kiln is worked out and it is pointed out that modern installations with mixed feed may approach rather closely to the theoretical. **F. O. ANDEREGG**

The cause of the deformation and the breaking of the stirrers in the mechanical pyrite burners. **K. SHABALIN.** *J. Chem. Ind. (Russia)* 5, 521–2; *Chem. Zentr.* 1928, II, 1712–3.—S. found that the rapid wear and breaking of the cast-iron stirrers and scrapers in the mech. pyrite burners is not due to the high temp. of the furnace, but is

due to the chem. effect of the pyrite-S. The analysis shows that the Fe of the scrapers is almost completely converted into FeS and that a layer of FeS₂ (mixed with FeS) has formed over it. S. assumes that in the transformation the S from the FeS₂-layer diffuses in one direction and the newly formed FeS diffuses in the opposite direction through the FeS-zone, thus giving rise to intermediate formation of FeS₂. G. S.

Sulfite liquor preparation from pyrites (LAUBER) 23. A ferro-alloy used in a plant for the preparation of synthetic NH₃ (RAFFO) 9.

Sulfur dioxide, etc., from iron pyrites. STANLEY I. LEVY. U. S. 1,730,514, Oct. 8. Iron pyrites is heated, in the absence of air, with Fe₂O₃, which serves to produce SO₂ and a residue readily reactive with HCl for producing H₂S and FeCl₂.

Decomposing complex hydrofluoric salts. MAX BUCHNER (to A. F. Meyerhofer). U. S. 1,730,915, Oct. 8. Complex salts such as Na₂SiF₆ or other fluosilicates or fluoroborates are heated by the action of hot gases, at a pressure less than atm. pressure, and under such conditions that no sintering takes place. Cf. C. A. 23, 2790.

Molybdenum phosphotungstate compounds. PAUL RABE, BERTHOLD WENK and ERICH HARTMANN (to General Aniline Works). U. S. 1,731,081, Oct. 8. By reduction of the 2 complex acids which have the general formula $n \cdot (WO_3 + MoO_3) \cdot P_2O_5 \cdot 3H_2O$, where n represents one of the numbers 24 and 18 (cf. Wu, C. A. 14, 2893) or their salts, new comds. can be obtained which are suitable for the manuf. of lakes. They form black crystals which are easily sol. in water with deep blue to violet color, stable in air and reconvertible into the molybdenum phosphotungstic acids by means of oxidizing agents. Cf. C. A. 22, 2816.

Phosphorus pentachloride from phosphate rock. CLAUDE G. MINER. U. S. 1,730,521, Oct. 8. Phosphate rock, silica and C are ground, formed into briquets, and the latter are heated in a reducing atm. in the presence of excess Cl to a temp. of redness or whiteness, PCl₅ formed is drawn off together with the excess Cl and C gases formed, and these products are cooled to below the decompn. temp. of PCl₅. An arrangement of app. is described. Cf. C. A. 23, 245.

Thorium hydride. HUGH S. COOPER (to Kemet Laboratories Co., Inc.). U. S. 1,730,723, Oct. 8. A specially described pure grade of Th powder is heated in H at 300-375° until the metal is substantially completely converted into hydride.

Recovering selenium from solutions. DANIEL L. OGDEN and ROGER I. VALENTINE (to United States Metals Refining Co.). U. S. 1,730,681, Oct. 8. SO₂ (in the absence of HCl) is introduced into a hot Se-bearing soln. such as a H₂SeO₃ soln. to ppt. Se in black amorphous form; the soln. is sepd., the wet ppt. is ground, and the Se is washed and dried.

"Synthetic" mineral fibers. MORRIS GROSSMAN. U. S. 1,730,609, Oct. 8. Na silicate is boiled with a soln. of NaOH under pressure for several hrs., the liquid is concd., the Na silicate is spun into fiber and the fiber is passed through a hardening bath of CaCl₂ soln. The product is resistant to heat and acids.

Rail filler. ALBERT C. FISCHER (to Philip Carey Mfg. Co.). U. S. 1,730,068, Oct. 1. Filler strips for placement along the sides of railway rails are formed of earthy material such as clay admixed with oil. Fibrous material may be added.

Cleaning and polishing fluid. EDWARD HAUGHEY. U. S. 1,730,654, Oct. 8. A compn. suitable for cleaning and polishing furniture, automobiles, etc., is formed of boiled linseed oil 63, turpentine 26, beeswax 8 and kerosene 3%.

Honing paste for use on razor strops. JAMES L. LANDER and GEORGE N. WHITE. U. S. 1,730,773, Oct. 8. An animal fat such as kidney fat is mixed with paraffin, paraffin oil, India rouge and finest Carborundum.

Composition for use as a shoe paste. EDMOND RETAILLIAU. U. S. 1,730,626, Oct. 8. PhOH 0.35, soap 1.8, ZnO 4.2, NH₄ sulfocinate 6.0, lithopone 13.0, citronella oil 0.1, glycerol 1.8, CaCO₃ 27.0, gelatin 4.0, aq. NH₃ 0.125 and water 41.625 parts by wt. are mixed together. Pigments may be added.

Waterproofed wrapped tubes. ARTHUR S. O'NEIL and ALBERT J. HINDRICH (to Western Cartridge Co.). U. S. 1,729,650, Oct. 1. A web of absorbent material such as paper is treated with an absorbable paste, rolled into a tube, and waterproofing material such as oil or varnish is applied to the surface of the tube before the paste has become absorbed, in order to facilitate impregnation by the waterproofing material.

Laminated dielectric sheets. HARRY P. MILLS (to Bakelite Corp.). U. S. 1,730,586, Oct. 8. One surface of a noncarbon-contg. sheet such as asbestos is coated with a C-free filler such as Na silicate and the uncoated side of the sheet is applied to a body

portion contg. a reactive phenolic resin, and the materials are subjected to heat and pressure together so that the resin only partially penetrates the sheet from the inner side and produces an integral union by hardening.

19—GLASS, CLAY PRODUCTS, REFRACTORIES AND ENAMELED METALS

G. E. BARTON, C. H. KERR

The constitution of glass. HERBERT SCHÖNBORN. *Sprechsaal* 61, 99–101, 117–20; *Chem. Zentr.* 1928, I, 2121.—General. C. R. FELLERS

Investigation of glass by the Margules method. M. VOLAROVICH. *J. Applied Phys. Moscow* 5, 185–91 (1928); *Physik. Ber.* 9, 2008 (in Russian with English summary).—The viscosity of a glass sample has been measured by the Margules method: the molten glass has been located in the clearance between a motionless Pt Ir cylinder and a concentric inside cylinder revolved regularly by the fall of a weight. The ranges were temp. 970–1390°, viscosities 176–21,700 abs. units. The viscosities could be calcd. satisfactorily by the Le Chatelier equation (cf. Deryagin and Khananov *C. A.* 23, 5375).

Investigation of the viscosity of glass by Stokes' method. B. V. DERYAGIN AND I. M. KHANANOV. *J. Applied Phys. Moscow* 5, 193–9 (1928); *Physik. Ber.* 9, 2008 (in Russian with English summary).—The viscosity of a glass sample has been detd. at various temps. by the Stokes method (falling Pt Ir ball). The results agree satisfactorily with those reported in the preceding abstr.

Antique glasses. BERNHARD NEUMANN. *Z. angew. Chem.* 42, 835–8 (1929).—Complete analyses of colored glasses from Egyptian, Babylonian and Roman sources are given. The widespread use of Cu, Mn and Fe (rarely Co) is noted. A. E. B.

Bichroux plate-glass process. J. E. FRAZIER. *Bull. Am. Ceram. Soc.* 8, 313–4 (1929).—A general description. C. H. KERR

Volatility of selenium and its compounds in the manufacture of ruby glass. J. B. KRAK. *J. Am. Ceram. Soc.* 12, 530–7 (1929).—About 75% of the Se added to the batch was lost by volatilization. Both Na_2SeO_3 and BaSeO_3 were stable at 950° and probably at higher temps. Regardless of whether Se or its compds. were used, the resulting glasses contained about the same amts. of Se. Methods of prep. Na_2SeO_3 and BaSeO_3 are given. A rapid analytical method of detg. Se in glass is given. C. H. KERR

Viscosity measurements in glass. H. R. LILLIE. *J. Am. Ceram. Soc.* 12, 516–29 (1929).—The concentric cylinder method (*C. A.* 23, 5375) was used for molten glasses. Results checked those of English and of Stott, but comparison with the results of Washburn indicates a difference supposedly due to his use of a variable calibrating factor. Measurements made by the use of a falling sphere gave results 25 to 50% higher than those given by the concentric cylinder method, possibly because of the extended extrapolation of Ladenburg's correction for finite boundaries. C. H. KERR

Clay. PAUL M. TYLER. U. S. Bureau of Mines, *Circ.* No. 6155, 62 pp. (1929).—Condensed information relating to the uses, properties, characteristics, testing, mining, technology and economics of clays. A bibliography is appended. K. D. JACOB

The burning of calcareous clays. OSKAR LECHER. *Chem.-Ztg.* 53, 669–71 (1929).—Methods of minimizing effects of CaO in clay ware are discussed. Analyses of limy clays are given.

A study of drying of clays and clay pastes. V. BODIN AND P. GAILLARD. *Bull. soc. encour. ind. natl.* 1929, 453–80.—Detailed tests on the drying time of French clays and clay pastes, with and without antiplastic materials, are given. E. M. SYMMES

Investigations for the improvement of potters' clays. GEZA JAKO. *Keram. Rundschau* 35, 283–5, 302–3 (1927).—A raw potters' clay, the analysis of which is given, served as the basis for expts. to det. the effects of various non-plastic admixts. on the resistance to crazing of the bodies after glazing. It is concluded that in a series composed of 50% of the raw clay and 25% each of two non-plastics the resistance to crazing is (1) best for bodies contg. magnesite and dolomite, (2) better for bodies contg. ground granite and ground slag than for those contg. ground clay grog or sand, (3) not as good for bodies contg. cement as for those contg. chalk. For bodies burned below 1000° the greater the amt. of clay substance present the more likely is the failure of the glaze.

The history of gilt (poliergold). I. II. F. CHEMNITZ AND P. NARR. *Chem.-Ztg.* 53, 573–4, 590–1 (1929). H. INSLEY
W. C. EBAUGH

The effect of various additive agents and treatments on the green strength of Missouri refractory clays. A. J. PAUL AND M. E. HOLMES. *J. Am. Ceram. Soc.* 12, 676-86(1929).—Tests were made with plastic and semiflint clays and burley diaspor. Aging plastic fireclay 10 days increased the modulus of rupture 38%. Na_2CO_3 treatment gave a 50% increase. Tannic acid produced some increase but an acid treatment after an alkaline treatment had no effect. The effect of developing bacterial growth was marked, especially when there was considerable aging. Adding bentonite (Collotone R) increased the modulus almost 3 times. The max. effect was with 8% bentonite. The additive effect of dextrin in combination with bentonite was positive but very small. Tennessee ball clay gave very little effect in amts. up to 8%. Na silicate, up to 8%, gave negative results. With flint clay, as little as 4% bentonite tripled the modulus. Aging helped greatly. With burley clay, bentonite increased the modulus to $4\frac{1}{2}$ times the original. Studies of mixts. indicated that the total colloidal content was the detg. factor. With 3% bentonite the modulus of flint clay is made equal to that of plastic clay. The deformation point of plastic clay dropped 1 cone for 3% and 2 cones for 6% addn. of bentonite. C. H. KERR

The rational (proximate) analysis of refractory clays by decomposition with sulfuric acid. HUBERT GREWE. *Arch. Eisenhüttenw.* 3, 43 8(1929).—The disagreements in the results of various methods for the proximate analysis of clay are caused principally by (1) the attacking of other constituents in the clay besides the clay substance, by the H_2SO_4 decompn. and (2) the residue of the decompn. not consisting entirely of KAlSi_3O_8 and quartz. A method giving satisfactory results is developed: In a porcelain dish (1000 cc.) are digested (5 min.) 1 g. clay (dried at 115°), 100 cc. H_2O and 5 cc. KOH (1:2); the mixt. is boiled (15 min.) and 100 cc. H_2O added. After cooling, 100 cc. H_2SO_4 (1.84) and 10 cc. HNO_3 are added. After heating in $1\frac{1}{4}$ hrs. to 140° and holding $1\frac{1}{4}$ hrs. here, the temp. is gradually (25 min.) raised to 230° and held here 35 min. After cooling, 600 cc. H_2O is added, the mixt. settled 2 hrs. and the clear soln. decanted off; to the residue 10 cc. HCl (1.19) and 50 cc. H_2O are added, the residue is heated on a H_2O bath (15 min.), filtered, washed with H_2O 3 times, the HCl treatment repeated until the weak green of the acid has disappeared. The residue is then washed into the dish, the vol. brought to 250 cc. with hot H_2O and 25 g. cryst. Na_2CO_3 (9 g. of calcined) is added. The mixt. is heated on a H_2O bath (2 min.), 5 cc. KOH (1:2) added, the mixt. heated (2 min.) again, filtered and the Na_2CO_3 KOH treatment repeated 3 times; the final residue on the filter is washed with H_2O contg. 5% alc., ignited in a Pt crucible and weighed. The difference between the initial and final wts is the wt. of clay. The ignited residue is decompd. by fusing with Na_2CO_3 and K_2CO_3 , the melt dissolved in dil. HCl, NH_4OH added in slight excess, the pptd. hydroxides filtered off and dissolved in HCl, and the Al_2O_3 pptd. with $(\text{NH}_4)_3\text{PO}_4$ and $(\text{NH}_4)_2\text{S}_2\text{O}_8$ as AlPO_4 from which the KAlSi_3O_8 in the original sample is calcd. The quartz is obtained by difference.

J. BALOZIAN

Experiments on the production of refractory clay ware. B. KAMER. *Keram. Rundschau* 35, 448-50(1927).—Formulas using Bohemian raw materials are given for the bodies, engobes and glazes of single-fire, cone-8, refractory clay ware. H. I.

Geologic relations of the diaspor and flint fireclays of Missouri. H. S. McQUEEN. *J. Am. Ceram. Soc.* 12, 687-97(1929).

C. H. KERR

Progress report on investigation of fireclay brick and the clays used in their preparation. R. A. HEINDL AND W. L. PENDERGAST. *J. Am. Ceram. Soc.* 12, 640 75 (1929).

C. H. KERR

An x-ray study of fire brick. ALBERT E. R. WESTMAN. Univ. Illinois Eng. Expt. Sta., *Bull.* No. 193, 16 pp.(1929).—The limitations of the petrographic microscope as a means for detg. the comps. of com. fire brick of fine structure led to the adoption of x-ray diffraction methods, whereby it was possible to obtain diffraction patterns of crystals as small as 50 A. U., as compared with those with diameters two thousand times larger; which were min. size for the other instrument. The diffraction patterns of all fireclay bricks were similar in appearance, mullite lines and one cristobalite line being present in all. Nearly all quartz lines were masked by those of mullite and cristobalite and the remainder were faint. The accuracy of estimates of amts. of each kind of crystal based on comparison of x-ray data with those from thermal expansion and petrographic measurements was not high. Moreover, there is no reason for believing that the 100,000 A. U. crystals are different in compn. from those whose diameters are smaller and the petrographic microscope should, therefore, prove adequate for such examns. The development of x-ray app. giving wider sepn. of the lines is desirable in the interests of ceramic research.

H. L. OLIN

Scum and efflorescence. ELLIS LOVEJOY. *Clayworker* 92, 205-8(1929).—Some

pertinent pointers are made relative to the causes and cures of scum and efflorescence of building brick. Some exceptions are taken to Palmer's statements (*C. A.* 22, 3750).

Dryer tests at the Bohnsack Brick Co. R. K. HURSH AND L. J. HAGEN. *Clay Worker* 92, 117-23(1929).

Development of zonal structure in silica brick. A. E. BADGER. *Fuels and Furnaces* 7, 1384(1929).—The colored zones of a silica brick taken from the crown of a glass tank are caused by migration of iron from the hot inner face of the brick as well as by the state of combination of the iron.

Some properties of silica bricks. L. LONGCHAMON. *Céramique* 32, 219-23 (1929).—L. discusses the raw materials, the quartz inversion, influence of alkalis, influence of Al_2O_3 , thermal expansion and refractoriness of siliceous products. Very pure quartz (99.9% SiO_2) was ground and then pressed into samples after the addn. of Na_2CO_3 . The samples were burned for 2 hrs. at 1250° and the densities were detd. The densities for 0.1, 0.2, 0.3, 0.4, 0.5, 0.6 0.7% Na_2O were, resp., 2.55, 2.41, 2.37, 2.34, 2.32, 2.30, 2.30. The decrease in d. shows the transformation of quartz to tridymite and cristobalite. The same expt. was performed with 0.5% Na_2O and 0.5, 1, 2 and 3% Al_2O_3 . The densities were, resp., 2.50, 2.55, 2.57, 2.30. It is evident that Al_2O_3 diminishes the speed of inversion of quartz and opposes the action of the alkalis. The thermal expansion of a sample of silica brick is always less than that which is calcd. from the mineralogical compn. However, if the sample is pulverized and again pressed into a specimen, the expansion is increased and agrees more closely with the calcd. This has been detd. by many repetitions of the expt. L. states that each crystal of SiO_2 in a silica brick is covered with a silico-calcareous cement and that the softening of such a brick at high temps. is due to the fusion of the cement.

Properties and specifications of silica bricks for coke ovens. H. KNUTH. *Feuerfest* 5, 21-6(1929).—Specifications include sp. gr., total porosity, silica content, durability and resistance to deformation at high temps.

Notes on terra cotta glaze consistency. H. SPURRIER. *J. Am. Ceram. Soc.* 12, 577-80(1929).

Lepidolite in cone 6 terra cotta glazes. H. E. DAVIS. *J. Am. Ceram. Soc.* 12, 570-1(1929).—There seems to be little or no improvement in the glaze except in beauty of glaze surface.

Ceramic research. J. W. MELLOR. *Bull. Am. Ceram. Soc.* 8, 269-72(1929).

Investigations in ceramics and road materials. 1927. Canada Dept. of Mines, *Mines Branch*, No. 697(1929).—Introduction. HOWELLS FRÉCHETTE. 1-3. An investigation on the treatment of certain western clays to overcome drying defects. HOWELLS FRÉCHETTE AND J. G. PHILLIPS. 4-16.—The cracking of several clays in drying was prevented by preheating the material to a temp. between 450° and 550° or by the use of grog plus 1 or more chem. coagulants; $FeCl_3$ or $FeCl_3 + NaCl$ were most efficient. Preliminary report on clay gathering. J. F. McMAHON. 17-25.—Costs ranged from 19 to 68.6 cents per ton of clay, and averaged about 38 cents for 20 plants. **Clays and shales of the Grand Lake Area, N. B.** HOWELLS FRÉCHETTE AND J. F. McMAHON. 26-45.—Tests on 13 samples of shales from the coal mines of this area show 12 suitable for ceramic use. Details of tests are given. **Road materials in Prince Edward Island.** R. H. PICHER. 46-59.—Results of a study of 16 deposits of conglomerate. **Stone quarries in Quebec.** R. H. PICHER. 60-7.—P. gives brief descriptions of 29 quarries. **The testing of non-bituminous road materials.** R. H. PICHER. 68-75.—P. describes methods of making tests on bed-rock for resistance to abrasion, toughness, hardness, sp. gr., H_2O absorption, cementing value and compression; on sand and gravel for granulometric analysis, character and shape of constituents, sp. gr., % of voids, abrasion, % of clay and silt, org. impurities and mortar tests. Methods of sampling are described.

Rapid method for the determination of boric acid in a borosilicate frit. WERNER MYLIUS. *Keram. Rundschau* 35, 550-2, 570-2, 585-7(1927).—The method comprises the fusion of the frit with KOH and the thrice repeated pptn. of SiO_2 , Al_2O_3 , PbO and other components after re-solution with a soln. of $Ba(OH)_2$. The total soln. obtained after filtering the ppt. is neutralized with 0.1 N HCl or 0.1 N $Ba(OH)_2$ and titrated in the presence of invert sugar sirup against 0.1 N $Ba(OH)_2$.

An alleged destruction of porcelain decoration by packing paper. BRUNO POSSNER VON EHRENTHAL. *Keram. Rundschau* 35, 532-3(1927).—A case of the bleaching of the colors in a porcelain decoration which had been ascribed to the chemical action of the paper in which the porcelain had been packed was found to be due to the electrolytic

action of metal and metal oxide particles in the decoration itself. The paper which had been in contact with these particles absorbed water and enhanced the electrolytic action.

H. INSLEY

The determination of the size of pore of ceramic filters by the systems air/liquid and liquid/liquid. H. BRECHOLD AND ROBT. SCHNURMANN. *Z. physik. Chem., Abt. A*, **142**, 1-24(1929).—The size of pore of ceramic filters is usually detd. from a measurement of the air pressure necessary to displace water from the filter. The authors have substituted MeOH, EtOH, Et₂O, *n*-PrOH, isobutyl alc., Me₂CO, CS₂, C₆H₆, PhNO₂ and toluene and found that the values agree very well with each other if the pores are not larger than 4 μ . For pores of greater size water and CS₂/air give larger values for the size than do the other liquids. When a system liquid/liquid (water/isobutyl alc.) was substituted for liquid/air, values were obtained which were 0.5-0.1 those obtained with the latter method. It is suspected that the wetting of the walls of the capillary by the second liquid may be responsible for the variations. The coalescing of subvisible droplets into visible ones (detd. by the viscosities of the liquids) may also exercise an influence. A balloon filter of Berlin porcelain, 3 types of Berkefeld filters, 4 types of Jena glass filters and 6 types of Chamberland thimbles were employed. Diagrams of app. and tabulated results are given.

E. R. SCHIERZ

The effect of water in expanding ceramic bodies of different compositions. H. G. SCHURECHT AND G. R. POLE. *J. Am. Ceram. Soc.* **12**, 596-604; *Bur. Standards J. Research* **3**, 331-41(1929).—With the exception of mixts. contg. blast-furnace slag or magnesite, most bodies with high absorptions developed considerable expansion. Adding magnesite improved the resistance to moisture expansion. Addn. of whiting, Fe₂O₃ and TiO₂ was not as beneficial as addn. of magnesite.

C. H. KERR

The capillary suction of some ceramic materials. A. E. R. WESTMAN. *J. Am. Ceram. Soc.* **12**, 585-95(1929).—A ball clay, a kaolin, flint, feldspar and mixts. of these were studied. The app. is described. Capillary suction decreases rapidly with increase in flint or feldspar. Ball clay had at least 3 times the capillary suction of kaolin.

C. H. KERR

Special depth gage for measurement and control of ceramic coatings. A. L. BENNETT. *J. Am. Ceram. Soc.* **12**, 572-6(1929).

C. H. KERR

Preparation of experimental sagger bodies according to fundamental properties. R. A. HEINDL AND L. E. MONG. *Bur. Standards J. Research* **3**, 419-44(1929).—Sec C. A. **23**, 4312.

E. C. M.

A new method of producing a salt glaze on ceramic ware. J. O. EVERHART. *Eng. Expt. Sta. News* (Ohio State Univ.) **1**, No. 6, 8-9(Sept., 1929).—A day slip of the same compn. as the body is used as a medium for carrying the salt. About 35% salt gave the best results. Spraying was better than dipping.

C. H. KERR

The effect of particle size of zinc oxide on the consistency of glaze slips. H. G. THOMPSON. *J. Am. Ceram. Soc.* **12**, 581-4(1929).—All brands of ZnO must be calcined. A small quantity of PbO is essential for satisfactory calcination. Calcining increases particle size. Control of consistency is therefore helped by calcining, because of the higher gravity and wider thinning range of the slip.

C. H. KERR

Fused quartz as a material for construction in the chemical industry. Z. VON HIRSCHBERG. *Korrosion* **4**, 25(1929).—A table gives the resistance of quartz to NH₄OH, NaOH, KOH, Na₂CO₃, Ba(OH)₂ and Na₂HPO₄.

M. C. ROGERS

Chemical and technological behavior of Roumanian kaolin. ALEXANDRU I. BRANISKI. *Bull. chim. soc. romăna stiinte* **29**, 15-77(1929); *Chem. Zentr.* **1928**, I, 2122. Kaolin from the several Roumanian deposits was examd. chemically, and by technological tests the value and adaptability of each deposit were detd. Sigistel, Medjidia and Popfalan clays were found best for fine ceramic ware, though the Fe content is high. Panic kaolin, after being freed from pyrites, ranks next in value for china ware. Zettlitz deposits possess very little plasticity. For porcelains, the kaolins of Parva, Dej and Rasca can be readily used. None of the Roumanian kaolins can be classed as really high grade.

C. R. FELLERS

Contributions to the knowledge of the physicochemical changes which take place in the burning of crystalline kaolin. L. MA RHODE. *Keram. Rundschau* **35**, 308-401, 414-5, 434-5, 452-4, 470-1(1927).—A well crystd. clay mineral ("pholerite") having the η and chem. compn. of kaolinite was the subject of the expts. Ground, air-dried samples were heated in a furnace at const. temps. for definite time periods. After cooling, the loss in wt., the η and the soly. in various reagents were detd. The wt. loss reached a different const. for each heating temp. and the max. wt. loss was obtained with a temp. of about 650°. The curve of wt. loss against η is a descending one, the η reaching a mean min. value of 1.48 at a wt. loss of 14% obtained by heating at 650° for 48 hrs.

The Al_2O_3 dissolved from the kaolinite by treatment with 6% HCl for 12 hrs. on a steam bath increased with the temp. of heating until a max. of 41.1% of Al_2O_3 was dissolved from material which had been heated for 2 hrs. at 750° . After 48 hrs. at 860° , 29.5% Al_2O_3 was dissolved, but after 96 hrs. at 860° only 1.3% Al_2O_3 was dissolved. The residue was an Al_2O_3 -free skeleton of silicic acid (a pseudomorph after pholerite) which retained the platy structure and a birefringence similar to the unheated crystals. The mechanism of the gradual production of "meta-nacrite" from "nacrite" or "pholerite" is unexplained as yet. After heating at 860° there is a sudden increase in n which remains practically const. until a temp. of 1200° is attained, when another sudden increase in n occurs. It is concluded that the residues after digestion with NH_4HF , and thorough washing are composed of a mixt. of Al_2O_3 and SiO_2 when the kaolin has been heated above 860° and below 1200° and that the residues are composed of mullite when the kaolin has been heated between 1200° and 1300° . H. INSLEY

Lead in red glaze. A. GRONOVER AND F. WOHLNICH. *Z. Untersuch. Lebensm.* 57, 360-3(1929).—The red glaze of certain culinary ware may contain PbCrO_4 and the conditions of extn. of the Pb for the purposes of analysis are discussed. It is recommended that the glaze be well scalded with hot water, $\frac{2}{3}$ filled with 4% vinegar and heated on the water bath for 30 min. Ten successive treatments of this type removed approx. the same amt. of Pb (about 7 mg.) for each extn. The Pb was detd. by Sudendorf and Penndorf's modification of Winkler's colorimetric method (*C. A.* 18, 134) and by the volumetric chromate method. After extn. a white, water-sol. efflorescence contg. carbonate, sulfate, acetate and Al was observed on the enamel. C. R. FELLERS

Refractory ceramics. I. The forms of zirconium dioxide. OTTO RUFF AND FRITZ EBERT. *Z. anorg. allgem. Chem.* 180, 19-41(1929).—The forms of ZrO_2 have been detd. with x-rays. The com. oxide, after preheating at 1200° , shows a reversible transition point at about 1000° from monoclinic to tetragonal symmetry. ZrO_2 freshly prepd. from the nitrate, oxalate or oxychloride below 600° , and cooled to room temp. shows a metastable tetragonal symmetry; but after a strong heating above 600° , this material does not differ from the com. oxide. The lattice const. and densities of both forms are as follows: monoclinic: $a = 5.174$ A. U., $b = 5.266$ A. U., $c = 5.308$ A. U., $\beta = 80.8^\circ$, $a.b.c. = 0.975:1:1.01$, $d = 5.68$; tetragonal: $a = 5.07$ A. U., $c = 5.16$ A. U., $d = 6.10$. Limited addns. of MgO , CaO , Sc_2O_3 , Y_2O_3 and CeO_2 to the solid phase and heating at 1700° cause a lattice transformation into a cubic system of the fluorite type. This cubic lattice is extraordinarily resistant toward thermic changes. The disintegration of refractory materials contg. ZrO_2 without foreign oxides is due to the cryst. transformation mentioned above. The addn. of foreign oxides stabilizes the lattice, insuring thus a very satisfactory refractory material. The same stable cubic lattice can also be obtained by mixing the necessary oxides with Zr nitrate, oxalate or oxychloride and heating then at 1400° : this method gives thus a mode of prepn. at lower temp. than the first-mentioned. It is highly probable that there exists a compd. $\text{Mg}_3\text{Zr}_2\text{O}_8$; the reasons in favor of its existence are thoroughly explained. Pure ZrO_2 does not retain its cubic structure up to its m. p. ALBERT L. HENNE

Refractories. F. TH. H. RAUCH. *Proc. Soc. Chem. Ind. Victoria* 27, Nos. 1-4, 1326-44(1927).—General discussion. K. D. JACOB

Glasshouse refractories of Europe. C. E. FULTON. *Bull. Am. Ceram. Soc.* 8, 315-9(1929).—General descriptions of equipment and processes at several plants. C. H. KERR

Dolomitic clinker as a stable basic refractory. M. E. HOLMES, W. J. McCAUGHEY AND G. A. BOLE. *Rock Products* 32, No. 15, 59-67(1929).—The field of stability in dolomitic clinkers lies in compns. contg. 5 to 8 or 9% SiO_2 provided a small amt. of Fe_2O_3 or Al_2O_3 (0.5%) is present. For rotary kiln practice addn. of Na_2CO_3 is necessary. RAYMOND WILSON

Recent advances in refractory material. W. OBST. *Feuerfest* 5, 4-5(1929).—A review of advances made since 1927. T. P. KELLER

The physical structure of refractory materials. THOMAS S. CURTIS. *Céramique* 32, 41-3(1929).—A review. A. J. MONACK

The permeability of refractory materials. R. V. WIDEMANN. *Céramique* 32, 185-95(1929).—W. describes the app. and presents data obtained on bauxite and aluminosiliceous refractories (Al_2O_3 varied from 20 to 38%) fired at different temps. A supplement gives a very detailed mathematical treatment of permeability. A. J. M.

Report of the Enamel Division Standards Committee, 1929. E. P. POSTE, *et al.* *Bull. Am. Ceram. Soc.* 8, 273-93(1929); cf. *C. A.* 23, 682.—A detailed report is made. C. H. KERR

Wet-process leadless cast iron enamels. A. I. ANDREWS AND C. H. COMMONS.

J. Am. Ceram. Soc. **12**, 557-65(1929).—Such an enamel is feasible. One good one and several fair ones were developed. The best results were obtained when the enamels were washed, but it is hoped that an insol. frit may be obtained. C. H. KERR

A method for testing the fineness of porcelain enamels. H. L. COOK. *J. Am. Ceram. Soc.* **12**, 566-9(1929).—A sieve-shaker method is described. C. H. KERR

Effect of soluble salts on the properties of enamels. R. R. DANIELSON. *J. Am. Ceram. Soc.* **12**, 538-47(1929).—If the mill liquors are excessively alk., the enamels have poor floating qualities. The ratio of free alkali to B_2O_3 dissolved from the frit is important in its effect on flotation. The value of an enamel clay cannot be detd. by floating the clay in H_2O . Tests must be made with the clay in the type of enamel with which it is to be used. In studying aging, the sol. salts must be considered. C. H. KERR

The effect on some colloidal chemical properties of kaolin of multivalent cations (ZHUKOV, SOKOLOVA) 2. Ball clays (SCOTT) 8. Colloid chemistry of the color problem of motley colored clays (GOGUEL) 8. Refractory materials used in Germany in the manufacture of chemical apparatus (KLIMOV) 1.

Porous refractory diaphragm for surface combustion apparatus. RUSSELL E. LOWE (to Doherty Research Co.). U. S. 1,731,053, Oct. 8. Structural features.

20—CEMENT AND OTHER BUILDING MATERIALS

J. C. WITT

French cement industry and its standards. H. PASSOW. *Zement* **18**, 994-6 (1929). H. F. K.

Recent investigation of cements. W. NAGEL. *Metallbörse* **19**, 1909-10, 1965-6 (1929).—Methods worked out in the Siemens labs. for investigating and standardizing cements are outlined briefly, with special reference to oxychlorides of Mg, Zn, etc.

W. C. EBAUGH

Aluminous fused cements in a magnesium sulfate solution. H. NITSCHÉ. *Zement* **18**, 973(1929).—Test specimens soaked in a 5% $MgSO_4$ soln. for periods up to 3.5 yrs. showed nearly as good compressive strength and better tensile strength than did those stored in tap water. H. F. K.

High-temperature cements. FRED A. HARVEY. *Fuels and Furnaces* **7**, 1401-7 (1929).—A discussion of the advantages of high-temp. cements over raw fireclay mixts. used to bond brick masonry. The method of applying mortar to bricks markedly affects the furnace life. A. E. BADGER

Anhydrite cement and its characteristics. P. P. BUDNIKOV. *Zement* **18**, 940-2 (1929).—The addn. of small quantities of $CuSO_4$ plus $NaHSO_4$ to deadburned $CaSO_4$ prevents the formation of "blooms" in the cement. With increasing CaO content the cement decreases in strength. It can be regenerated without the addn. of catalysts. H. F. K.

The relation of quality to cost of production of portland cement. EDUARDO TAYLOR. *Rock Products* **32**, No. 16, 64-5(1929).—The increased cost of fine grinding of a high lime raw mix is offset by better grindability of the clinker produced and lessened tendency to the formation of "fire rings" in the kiln. RAYMOND WILSON

Changes in characteristics of portland cement and high-early-strength cement during storage. HAEGERMANN. *Zement* **18**, 1022-8(1929).—Both kinds of cement suffered a reduction in sp. gr., degree of fineness, and early strength, and gained in loss on ignition with storage up to 1.5 yrs. H. F. K.

Composition and properties of the so-called natural cements. HAEGERMANN. *Zement* **18**, 861-8(1929).—See C. A. **23**, 4546. H. F. K.

Calculation of the compounds in portland cement. R. H. BOGUE. *Ind. Eng. Chem., Anal. Ed.* **1**, 192-7(1929).—The math. and graphic calcns. of the content of $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, $3CaO \cdot Al_2O_3$, $2CaO \cdot SiO_2$, $3CaO \cdot SiO_2$, uncombined MgO , uncombined CaO and $CaSO_4$ are described in detail. W. T. H.

Röntgen ray studies of cement. H. W. GONELL. *Zement* **18**, 968-9(1929). H. F. K.

Chemical, microscopic and Röntgen-ray analyses of alite and their results. A. GUTTMANN and F. GILLE. *Zement* **18**, 912-8(1929).—The examn. of the principle constituent of portland cement clinkers of different compn. showed this to be identical

microscopically with the crystal form alite and to consist chemically of practically pure tricalcium silicate. H. F. K.

The effect of calcium chloride on some of the physical properties of portland cement. S. UCHIDA. *Concrete* (Mill Section) 35, No. 4, 112-4(1929).—CaCl₂ accelerates the setting and hardening of portland cement, the optimum quantity being about 3% by weight of the cement. RAYMOND WILSON

The effect of the fineness of portland cement on its properties. P. FILOSOFOV. *Tonind-Ztg.* 53, 1302-4(1929).—A cement was sepd. into 2 fractions by sieving. Test specimens were made with various mixts. and it was found that the setting time depended upon the fineness. The 7-day tensile strength also followed the fineness, but 28-day and longer strengths were higher if the initial cement was not quite so fine.

F. O. ANDEREGG

The effect of organic impurities on the mechanical properties of portland cement. F. FEW. *Chem. Eng. Mining Rev.* 21, 441-3(1929).—F. assumes in his expts. that tannic acid is the harmful impurity in soil. 1:3 mortars were made contg. 0.1 to 0.5% tannic acid. In all cases 7- and 28-day tensile tests showed a weakening effect of tannic acid increasing with the amt. With 0.1% the tensile strength at the end of 7 days was 294 lb. per sq. in., with 0.3%, 184 and with 0.5%, 134 as compared with 297 with no tannic acid. At the end of 28 days the % loss was less. The compressive strength was affected likewise. H. C. PARISH

Effect of the temperature of salt solutions and of the mortar structure on the behavior of portland cement in active solutions. E. PROBST AND KARL E. DORSCH. *Zement* 18, 1090-5(1929).—The action of 15% solns. of Na₂SO₄ and of (NH₄)₂SO₄ was more severe on mortar specimens at a temp. of 30° than at 15° and -5°. Specimens made of Rhine sand were more dense and more resistant to these solns. than standard sand briquets. H. F. K.

Burning of cement in powder form. SCHIRM. *Zement* 18, 996-1000(1929).

H. F. K.

The theory of cement burning. HANS KÜHL. *Tonind.-Ztg.* 53, 1397-1401(1929).—An address. F. O. ANDEREGG

Lime combinations during the burning of portland cement. W. SCHRIEVER. *Zement* 18, 886-7(1929).—The progressive formation and combinations of CaO in different portions of the kiln were followed by the tensile and compressive strengths developed in the resulting cements. The greater part of the lime is combined with SiO₂ and Al₂O₃ before the calcination is complete. The later period of combination occurs where temps. of 1100-1300° are reached. H. F. K.

The setting of portland cement. DANIEL AVDALIAN AND E. N. GAPON. *Giorn. chim. ind. applicata* 11, 203-6(1929).—A math. paper. The velocity of setting of portland cement may be expressed by $1/t \log (w_0 - w_\infty)/(w_1 - w_\infty) = K$, in which w_0 is the value of any property at the start, w_∞ , the same property after set, and w_1 , this property at the time t . A. W. CONTIERI

Is the water-cement ratio the last word? NATHAN C. JOHNSON. *Eng. News-Record* 103, 471(1929).—It is pointed out that there are many problems for which the water-cement ratio offers no solution or clue. Sepn. and lack of uniformity in mix because of the wash-out action of too much mixing water are as important as reduction in strength. R. E. THOMPSON

The determination of iron oxide in the cement mill laboratory. ROBERT R. KING. *Rock Products* 32, No. 19, 72-3(1929).—K. recommends reduction of Fe in HCl soln. with SnCl₂ and titration with K₂Cr₂O₇, with diphenylamine as inside indicator. R. W.

Waste heat in cement mills and paper mills. H. B. SMITH. *Proc. Eng. Soc. West Penn.* 45, 269-96(1929).—First consideration must be given to continuity of service and flexibility, and to the draft loss upon which depends: the successful and efficient operation of the primary furnace, the net steam output and the life of the induced draft app. The draft loss is increased by air infiltration, improperly designed flues and too many turns and eddies. Gas velocities are an important feature of the design. Justification of a waste-heat installation depends upon the furnace cycle, the temps. of the gases and the cost of purchased power. The life of the induced-draft fans is materially extended by plating, either electrically or with C₂H₂ gas on the portions of the blades where the abrasion occurs. The burning of addnl. fuel in the waste-heat system during regular operation is inadvisable. Excess air must be kept to a reasonable min. Recent improvements in some installations in the cement and paper mills are indicated. An extended discussion is included—particularly relative to the value of interchange between the control stations and the industrial plant. W. H. BOYNTON

Grindability of portland cement clinker. ALTON J. BLANK. *Rock Products* 32,

No. 19, 50-2(1929).—Air-cooled clinker is more easily ground than water-cooled clinker in preliminary grinding; in finish grinding the relation is reversed. **RAYMOND WILSON**

Steam curing of portland cement mortars. A new crystalline substance. **T. THORVALDSON AND G. R. SHELTON.** *Can. J. Research* 1, 148-54(1929).—The rate of hydration of the cement increased with the temp. of the satd. steam. $\text{Ca}(\text{OH})_2$ crystals appeared almost at once, but after reaching a max. decreased in amt. At the same time a new cryst. product appeared, increasing as the $\text{Ca}(\text{OH})_2$ decreased. The stability of these crystals to sulfate solns. indicates that the increased resistance of portland cement mortars to alkali action produced by steaming is connected with the production of this cryst. material. The crystals are decompd. by dil acids but are stable in NaOH solns. Na_2SO_4 or CaSO_4 solns. do not attack them. They are slowly decompd. by MgSO_4 solns., however. They are apparently rich in CaO . A temp. of 135° does not change them. At 400° some roughening of crystals at edges occurs. Even after prolonged heating at 650° their entire cryst. structure was not destroyed. **H. C. PARISH**

Weathering of the Bremen Town Hall. **E. BLANCK AND A. RIESSER.** *Chem. Erde* 4, 137-44(1928).—A study of the chem. changes on weathering of the sandstone of the Bremen town hall shows the progressive changes with age. Analyses of fresh and weathered sandstone and sol. material derived on leaching are given. **J. F. S.**

Effect of coarse aggregate on the quality of concrete. **KURT PFLETSCHINGER.** *Zement* 18, 955-8, 977-80, 1005-8, 1035-40(1929).—The kind, size, surface factors and quantity of coarse aggregate affect the quality of concrete. With a sand having 20% below 50 mesh it was found that gravel gave higher compressive strength values than broken stone for the same cement content, while in transverse tests the reverse was true. Gradation of the coarse aggregate seemed to be of less importance. The attempt is made to base the amount of sand added to the batch by the size of the largest material in the coarse aggregate. The $\text{H}_2\text{O}/\text{cement}$ ratio is used in explaining results. **H. F. K.**

Effect of mixing time on the quality of concrete. **HALLER.** *Zement* 18, 900-2(1929).—By using sand and gravel aggregates in a 1:2:3:4 mix only minor differences in the compressive strengths were noted in the resulting concrete when the time of mixing the batch was varied $1/2$ -3 min. **H. F. K.**

Deterioration of concrete in hydraulic structures. **AXEL FRWALL.** *Concrete* 35, No. 4, 21-2(1929).—A summary of a report by the Swedish Board of Waterfalls. Permeability of concrete is given as the chief cause of deterioration. **RAYMOND WILSON**

Prevention of percolation through dams. **JOSEPH A. KITTS.** *Eng. News-Record* 103, 430(1929).—Discussion of paper by Bowers (*C. A.* 23, 4984). The factors affecting the quality of concrete are discussed, with particular reference to technical control and workmanship. The need of a pozzolanic constituent in concrete to convert the free lime to Ca silicate is pointed out. **R. E. THOMPSON**

Concrete aggregates and their application. **K. SCHAECHTERLE.** *Beton u. Eisen* 28, 313-20(1929).—Details have been worked out for the practical and economical application of modern ideas of aggregate grading and a description is given of a plant developed for that purpose. **F. O. ANDEREGG**

Building limes. I. Putty density and volume yield. **A. D. COWPER AND J. F. WILLIAMS.** *J. Soc. Chem. Ind.* 48, 276-9T(1929).—Detn. of putty d. of a lime adjusted to a standard consistence is a convenient method of detg. vol. yield. The d. of wet $\text{Ca}(\text{OH})_2$ is const. over a wide range of conditions. **E. M. SYMMES**

Twenty years of treated ties on the Northern Pacific. **ANDREW GIBSON.** *Eng. Maintenance* 25, 347-8(1929).—Since 1907 the Northern Pacific R. R. has been treating all of its track ties in plants at Brainard, Minn., and Paradise, Mont., using 80% creosote and 20% refined coal tar, or 50% creosote and 50% petroleum. With treated ties, the tie renewal has shown a decrease of about 53%, and practice has not only extended service life of timber but has permitted use of inferior woods. **R. C. BARDWELL**

Wood preservation. **KRHUZKAM.** *Chem.-Ztg.* 53, 650-1(1929).—The timber treating processes now in use in Germany are described. The preservatives used are ZnCl_2 , CuSO_4 , HgCl_2 , NaF combined with nitrated phenols and cresols, and creosote. The latter is used chiefly with the empty-cell or Rueping process. Ties are added and bored before treatment. Frequently the tie plates are applied at the plants before distribution on the railroad right-of-way. Tie treatment for the German railways is done mostly by privately owned plants under contract. **ALFRED L. KAMMERER**

Reinforced concrete [as water-pipe material] (SAVILLE) 14. Particle size and the properties of matter [in manufacture of portland cement] (NEVILLE) 2. Manufacture

of dolomite cements (ŠIMANĚ) 8. Mortar for the construction of coke ovens (ROBINSON) 21. Investigations in ceramics and road materials (ANON.) 19. A study of fiber wall boards for developing standards (SCRIBNER, CARSON) 23.

Cement from slag. JOHN G. BERGQUIST. U. S. 1,731,189, Oct. 8. Molten slag is taken from the furnace in which it is produced, poured into a second furnace where sufficient lime is added to form a dicalcic silicate, the product is permitted to cool and disintegrate to a powder, mixed with previously pulverized limestone, the mixt. is wetted and ground, burned to a clinker, and the clinker is ground.

Testing the consistency of concrete by use of a movable resistance indicator in the path of the moving material. ERICH H. LICHTENBERG (to Koehring Co.). U. S. 1,730,893, Oct. 8. An app. is described.

Waterproofing stone for use in road-building, etc. SAMUEL S. SADTLER (to Amiesite Asphalt Co. of America). U. S. 1,730,245, Oct. 1. Stone is heated to expel moisture, treated with a mixt. of fuel oil and kerosene or other non-saponifiable water-immiscible substance contg. a fatty acid of low volatility and sufficiently fluid to permit natural absorption by the stone, and allowed to stand to permit penetration by the treating material.

Arrangement of aggregate in pavements, etc. CLARENCE WRIGHT (to Wright Rubber Products Co.). U. S. 1,730,259, Oct. 1. Structural features of a pavement which may be surfaced with blocks of rubber.

Paving joint composition. ALBERT C. FISCHER (to Philip Carey Mfg. Co.). U. S. 1,730,000, Oct. 1. Paving joints are formed of a single compressible layer of bituminous material of sufficient thickness to form a complete joint and comprising vegetable blades such as those of *Yucca glauca*. Cf. C. A. 22, 3747.

Bituminous pavements. LEON R. MACKENZIE. U. S. 1,729,884-5, Oct. 1. Structural features.

21—FUELS, GAS, TAR AND COKE

A. C. FIELDNER

Fuel efficiency tests on batch oil stills. HENRY KREISINGER, W. R. ARGYLE AND W. E. RICE. Bur. Mines, *Bull.* 302, 94 pp. (1929).—Detailed combustion data (including thermal balances and efficiencies) of 103 tests on batch stills using the fire- and steam-method of distn. and fired with coal on chain grates and under-feed stokers, fuel oil and producer gas are given. Burning auxiliary gas under coke stills is unnecessary. Steam used in the fire- and steam-distn. process should be superheated to the temp. of the oil by waste flue gases. Air for combustion should be similarly preheated. By using high gas temps. and low excess air the fires will be operated more efficiently than at present, the time of distn. will be reduced, and thermal efficiencies will be increased. Higher efficiency can be expected from the use of oil or gaseous fuel than coal on a chain grate because of the ease of adjustment of the former to meet conditions. Distribution of charged heat was approx.: moisture in flue gas 7, combustible in ash 5, sensible heat in furnace walls 4, radiation and convection from furnace and still 4 and losses in dry flue gas and efficiency 80%. One-third of the coal and $\frac{1}{3}$ of the time were saved by skilful firing in a furnace properly redesigned and equipped with a stoker suited to the requirements of the process and the coal. Details of design are given; in general, parts subject to high temps. were shielded by arches and baffles were used to force the hot gases to scrub the max. surfaces of the stills at high velocity.

ALDEN H. EMERY

Comparative tests of various fuels when burned in a domestic hot-water boiler. E. S. MALLOCH AND C. E. BALTZER. Can. Dept. Mines, *Mines Branch, Rept.* No. 705, 92 pp. (1929); cf. C. A. 22, 310.—Detailed results and discussion of 123 tests using 30 fuels from peat to anthracite are given. The anthracites and cokes (fixed C 75-92%) gave high thermal efficiencies (av. 72.9%) and required only 10.78 lb. of fuel per therm of delivered heat. They required the least attention, gave the least clinker and usually produced a small amt. of ash. The semi-bituminous coals (fixed C 70-74%) averaged 65.8% thermal efficiency and used 11.07 lb. of fuel per therm. They produced less refuse than the anthracite and coke, but required much more attention. The Alberta sub-bituminous and domestic coals (fixed C 39.8-50.5%) ranged from 58.5 to 63.3% (av. 60.8%) thermal efficiency and required from 14.77 to 19.06 lb. of fuel per therm. The refuse was about an av. of the preceding but clinker formation was much greater. More attendance was required than for the preceding. Peat (fixed C 22%) gave a thermal

efficiency of 54.4% and used 25 lb. of fuel per therm. It demanded the most attention.

Alcohol for power purposes. FREDERIC NATHAN. *Trans. Fuel Conference, World Power Conference, London 1928 3*, 1255-71(1929).—By a consideration of the alc. yield per acre of various vegetables, together with the costs of production, alc. is ruled out as a possible motor fuel except under special conditions. ALDEN H. EMERY

Coal washing. A. MORREAU. *Rev. ind. minérale 1928*, 335-40, 349-58, 373-80.—The math. relationship between the elementary and the cumulative washability curves of the coal is given and a graphical method is shown for deriving either one or the other and for detg. the content of the washed coal, middlings and refuse. The mixing of coals of different characteristics before or after washing is discussed mathematically and graphically. Mixing after washing is usually preferable. The washability curves are detd. from jigging tests in a small washer or by heavy-liquid sepn. The use of such curves in choosing a suitable washer is discussed. B. M. BIRD

Temperature for rapid self-heating of powdered coal and the semicoke made therefrom. F. A. HARTGEN AND DAVID F. SMITH. *Bur. Mines, Repts. Investigations No. 2960*, 5 pp., 18 figs.(1929).—The temp. for the rapid self-heating of coal is from 50° to 80° less than for coke (195°). ALDEN H. EMERY

Low-temperature carbonization. C. H. LANDER AND F. S. SINNATT. *Trans. Fuel Conference, World Power Conference, London 1928 3*, 997-1014(1929); cf. *C. A.* 22, 2653, 3757; 23, 2015.—A general discussion is given. A table gives complete data (amts. and compn.) on the yields from 11 low-temp. processes. ALDEN H. EMERY

The Pehrson process for low-temperature carbonization. W. R. CHAPMAN. *J. Soc. Chem. Ind.* 48, 267T(1929); cf. *C. A.* 23, 5027.—Any coking slack can be used for carbonization, and the size of solid fuel obtained can be controlled by regulation of the preheating process. W. C. BRAUGH

The present state of low-temperature carbonization in Germany. R. HEINZE. *Trans. Fuel Conference, World Power Conference, London 1928 3*, 1015-91(1929).—For the low-temp. carbonization of brown coal, externally heated retorts, such as the Rolle, Streppel, Sauerbrey, Honigmann-Bartling, Geissen, and O. Heller, and ovens heated internally by gases, such as the Limberg, Lurgi, Drawe and Pintsch for raw coal and the Allgemeine Vergasungs-Gesellschaft, Seidenschur-Pape, Deutsche Erdöl A. G. and Humboldt for briquets, are individually described and illustrated. Mainly the rotary-type retort is used for the carbonization of true coal. Only the K. S. G. type is still in operation. The Doppelstein ovens and the Chemisch-Technische Gesellschaft cells are discussed. The Delkeskamp process is used for enriching the calorific value of low-grade fuels, such as brown coal, lignite, peat, etc., by reducing the CO₂ and H₂O and increasing the fixed C. The article is profusely illustrated. ALDEN H. EMERY

Peat fields in Latvia, and the use of peat as a fuel. P. NOMALS. *Trans. Fuel Conference, World Power Conference, London 1928 3*, 1148-62(1929).—Tables are given showing the area of individual peat fields in Latvia (total 643,300 hectares); partial analyses (ash, H₂O, vol. of dry peat/cu. m. of wet peat, calorific value, and energy/cu. m. of wet peat) of material from different depths of 9 bogs; analyses of ash (moss 1-5%, grass 5-10%); analyses of dry peats for volatile matter, ash and fixed C; analyses of dry org. matter from peat for volatile matter (52-70%) and fixed C (30-48%); ultimate analysis of dry org. matter (C 52-60, H 5-7, O 31-41, N 0.7-3.4); and fuel value of prepd. peats. Peat furnishes less than 2% of the yearly fuel requirements of Latvia. ALDEN H. EMERY

Methods employed in the U. S. S. R. for the production of peat. SCIENTIFIC EXPERIMENTAL INSTITUTE OF PEAT (RUSSIA). *Trans. Fuel Conference, World Power Conference, London 1928 3*, 1163-86(1929).—Eight methods of cutting peat are described with efficiency and production figures for each. ALDEN H. EMERY

Peat combustion practice in the U. S. S. R. SCIENTIFIC EXPERIMENTAL INSTITUTE OF PEAT (RUSSIA). *Trans. Fuel Conference, World Power Conference, London 1928 3*, 1187-1210(1929).—Tests of peat combustion on chain grates are given and a new type, a disk grate, is described. ALDEN H. EMERY

Peat treatment. GUSTAV KEPPELER. *Trans. Fuel Conference, World Power Conference, London 1928 3*, 1123-30(1929).—The heating value of peat (5200 cal./kg.) is hardly sufficient to drive off the H₂O(90%) if used directly as fuel. Air drying of sods produces a bulky fuel which easily reabsorbs H₂O. If ground peat is dried, the colloidal humus forms a dense mass (including the plant residues) which will not absorb H₂O. The mass can be molded into briquets. Artificial drying is difficult. Pressure drying can be done at low pressures, but the time element is considerable. Peat is excellent for gasification; the gas has a heating value of approx. 1400 cal. If low in H₂O (30%) it can

be carbonized (450–600°). The coke is low in ash ($2\frac{1}{2}$ –4%) and contains 0.2–0.33% S.

ALDEN H. EMERY

The drying of peat. NILS TESTRUP AND THOMAS GRAM. *Trans. Fuel Conference, World Power Conference, London 1928* 3, 1131–47(1929).—Various methods of drying peat are described. A 4-effect steam drier was most effective, economically reducing H_2O from 80 to 10%. Power could be produced (30,000 kw. capacity) at about 0.13 cents per kw. hr. at 100% load factor and about 0.2 cent at 60% load factor from peat so treated.

ALDEN H. EMERY

Experimental work on the artificial dehydration of peat and its conversion into powder and briquets. SCIENTIFIC EXPERIMENTAL INSTITUTE OF PEAT (RUSSIA). *Trans. Fuel Conference, World Power Conference, London 1928* 3, 1211–32(1929).—A method for the dehydration of hydraulically produced peat to 15% H_2O is described. It consists of coagulation with $Fe(OH)_3$, vacuum filtration, high-power pressing and drying in rotary steam driers. Highest quality briquets are made when the peat contains 15–18% H_2O .

ALDEN H. EMERY

Analysis of a peat profile. REINHARDT THIESSEN AND R. C. JOHNSON. *Ind. Eng. Chem., Anal. Ed.* 1, 216–20(1929).—A study of the microbiological formation of peat was undertaken with the assumption that a better knowledge of the nature and chemistry of peat should reveal the nature and chemistry of coal.

T. P. KELLER

Acids of montan wax. D. HOLDE, W. BLAYBERG AND H. VOHER. *Brennstoff-Chem.* 10, 101 8, 124 8(1929).—The Et esters of the acids are fractionally distd. at low pressure. The acids are then set free and sepd. by fractional pptn. of their Li salts. An acid, $C_{28}H_{56}O_2$, m. 84.4°, is sepd. and identified. An iso-acid, $C_{22}H_{44}O_2$, m. 89°, is also isolated and an acid, $C_{30}H_{60}O_2$, is also probably a constituent of montan wax. An acid, $C_{29}H_{58}O_2$ (C. A. 16, 2111, 3464; 23, 4326) was not isolated. The methods available permit of only approx. quant. sepn. of the homologous fatty acids.

J. D. DAVIS

Smokeless combustion in domestic heating plants. VICTOR J. AZBE. *Mech. Eng.* 51, 761–4(1929).

E. J. C.

Experiments with Diesel-engine-driven locomotives on Russian railways. P. YANOUSHEVSKY. *Trans. Fuel Conference, World Power Conference, London 1928* 3, 700 23(1929).—Based on 85,000 km. of operation of 2 Diesel engine locomotives, running costs will be about 75% those for steam. A bibliography of 295 references is appended.

ALDEN H. EMERY

Influence of the use of the heavy-oil engine on the world economy of combustible liquids. M. DEFAYS. *Trans. Fuel Conference, World Power Conference, London 1928* 3, 587–97(1929).—Advantages of the use of high-speed heavy-oil engines over gasoline engines lie in (1) lower cost of fuel ($\frac{1}{3}$ – $\frac{1}{2}$), (2) reduction of fire hazard and (3) universal application (economically replacing steam for locomotives, etc.). Several engines are described.

ALDEN H. EMERY

The present position of the high-speed heavy-oil automobile engine. W. RIEHM. *Trans. Fuel Conference, World Power Conference, London 1928* 3, 626–47(in German), 647 61(in English)(1929).—R. describes a no. of engines of this type and discusses possible fields of usefulness.

ALDEN H. EMERY

Peat gas among natural carburants. GEORGES KIMPFLIN. *Chaleur et ind.* 9, 547–60(1928).—Account of a discussion.

S. L. B. ETHERTON

The manufacture and use of high-quality gases from gas-oils and low temperature tars. W. FRANKENSTEIN. *Erdöl u. Teer* 5, 476–7(1929).—The construction and operation of the Pintsch retort are described.

W. A. GALLUP

Water gas in the United States. D. STAVORINUS. *Het Gas* 49, 339–44(1929).—A review.

B. J. C. VAN DER HOEVEN

Rust protection of gas holders. P. BROUWER. *Het Gas* 49, 417–9(1929).—Some details are given of the construction and upkeep of gas holders, cost of painting, etc. Al graphite paint was in excellent condition after 5 years.

B. J. C. VAN DER HOEVEN

The practice of dry purification. S. DE JONG. *Het Gas* 49, 425–33(1929).—A review.

B. J. C. VAN DER HOEVEN

Gas purification in particular by liquids. D. STAVORINUS. *Het Gas* 49, 459–64(1929).—A review of liquid purification systems, specially those of the Am. Koppers Co. and of Gluud-Schönfelder. Some cost data are given, also references.

B. J. C. VAN DER HOEVEN

The Thylrox process for liquid purification of gas. J. H. STEINKAMP. *Het Gas* 49, 408–11(1929).—A review.

B. J. C. VAN DER HOEVEN

Analyses of some natural gasoline gases before and after treatment. H. C. ALLEN. *Ind. Eng. Chem., Anal. Ed.* 1, 226–7(1929).—Three typical natural gasoline gases were analyzed and the results discussed in conjunction with plant operations.

T. P. KELLER

Determination of neon in natural gas. N. P. PÉNTCHEFF. *Compt. rend.* 189, 322-4(1929).—First remove the common gases from 5-6 l. of natural gas by means of Ca, CuO, etc., then treat with C black at the temp. of liquid air. In this way a mixt. of Ne and He can be isolated. By detg. the d. the He content can be estd. W. T. H.

Standard methods for avoiding gas leaks. A. SCHAFER. *Gas Wasserfach* 72, 921-7(1929).—Correct methods for laying and joining pipes are discussed as well as causes of corrosion and methods for preventing corrosion. A novel method of using a water seal completely to isolate a portion of the mains is given. Gas leaks are detected by smelling special "smelling pipes" or by smelling adjoining manholes before trouble occurs. In a test of workmen, it was discovered that 74% could smell 1.5% gas, 59%, 1% gas and 36%, $\frac{1}{2}$ % gas. R. W. RYAN

Heating Martin furnaces with mixed blast-furnace and coke-oven gas. M. CONTE. *Chaleur et ind.* 9, 384-9(1928). S. L. B. FETHERTON

The treatment of spent gas liquors. A. C. MONKHOUSE. *Surveyor* 76, 37(1929).—The compn. of gas liquor is divided into 3 groups: "free" NH_3 salts, "fixed" NH_3 salts and phenols; higher tar acids; and pyridine bases. Percolating filters have handled gas wastes contg. 8% spent gas liquor without drop in filter efficiency. A. L. ELDER

The reactivity of coke. D. J. W. KRENLEN. *Brennstoff-Chem.* 10, 128-31, 148-53, 168(1929).—Reactivity is detd. by passing air over a sized coke sample in a Pt boat heated in an elec. tube furnace. After charging, the sample reaches the furnace temp. in 2 min. Air is then passed for 5 min. at 20 l. per hr. and the CO_2 formed is absorbed and subsequently weighed. Reactivity is expressed in mg. CO_2 formed per sq. cm. of coke surface exposed. K. believes that in controlling the area of coke exposed he has eliminated the effect of particle size and that of blanketing of the coke by CO_2 previously formed so that he detcs. only reaction velocity, which he calls the true reactivity of the coke. Curves given, in which reactivity is plotted against temp., show a wide variation in reactivity within the range 500-600°, but a small variation at 800°. The main conclusion is that at temps. 800° and above, the true reactivity for all cokes is practically the same. J. D. DAVIS

Removing combustible coke from coke ash at Krefeld. KURT BEUTHNER. *Gas Wasserfach* 72, 927-8(1929).—A description is given of the Krefeld plant for removing combustible coke from producer ashes. Screened ashes are passed over a magnetic separator. About 100 tons of coke of 15-20% ash is prepd. from ash contg. 15-20% combustible, at a cost of 3 to 4 M per ton. R. W. RYAN

The present status of the low-temperature coking of coal in Germany. R. HEINZE AND A. THAU. *Papier-Fabr.* 27, 456-8(1929).—A brief survey. R. H. DOUGHTY

Mortar for the construction of coke ovens. P. B. ROBINSON. *Feuerfest* 5, 13 5 (1929).—A good mortar must have the proper plasticity, cohesion and be impervious to gases. Recommended mortars: for fire brick, 50-25-25 of clay, grog and sand; for silica brickwork in coke ovens, 10-30-60 of plastic clay, grog and ganister; for construction in gas works a mortar of finely ground ganister with 5% of lime. T. P. K.

Properties and specifications of SiO_2 bricks for coke ovens (KNUTH) 19. Fuel saving in steel making (DE MARÉ) 9. Certain principles in the extended utilization of blast-furnace gas (RICE) 9. Blast-furnace gas cleaning (MCGURRY) 9. Production of $(\text{NH}_4)_2\text{SO}_4$ (WESTPHAL) 4. Eighth annual report of Ohio Conference on Water Purification (ANON.) 14. The thermal behavior of the phenols (HAGEMANN) 2. Strainer for liquid fuels (U. S. pat. 1,730,360) 22. System of partial liquefaction for separating H from gaseous mixtures such as coke-oven gas (U. S. pat. 1,730,805) 13.

Hydrogenating carbonaceous materials. PAUL DANCKWARDT. U. S. 1,730,997, Oct. 8. Material such as a mixt. of coal or wood and oil or tar is forced together with H and steam under high pressure through a body of molten metal hydroxide such as NaOH and subjected to electrolysis with finely divided Ni as the negative pole and an anode consisting of an elec. conductor through or near which fixed hydrocarbon gas is injected; the C-contg. material is permitted to escape into another vessel where the light hydrocarbons may be sepd. from the heavier ones, and the latter and the fixed C-contg. material are returned to the electrolyzer for retreatment. An app. is described.

Muffle furnace and retort construction suitable for carbonizing coal, etc. FRANK C. GREENE and OTTO H. HERTEL. U. S. 1,730,570, Oct. 8. Structural features.

Apparatus for distillation of solid carbonaceous material such as coal. OTTO H. HERTEL. U. S. 1,731,165, Oct. 8. Details are described of an app. comprising a vertical retort through which extends a vertical rotatable pipe (within which a gas burner is

mounted) which on rotation creates a passage through the charge and which serves also to supply heat to the interior of the charge. The retort is also externally heated.

Furnace and vertical cylindrical retort construction, etc., for coal distillation, etc. FRANK C. GREENE and IRVING F. LAUCKS (to Old Ben Coal Corp.). U. S. 1,730,569, Oct. 8. Structural features.

Boiler furnace efficiency determination. JACOB M. SPITZGLASS (to Republic Flow Meters Co.). U. S. 1,730,541, Oct. 8. An index of the state of the flue gases is obtained by measuring the percentage of CO_2 in them; the temp. of the flue gases in the stack is detd. as is also the temp. of the air supplied to the furnace, and the difference between these temps. is multiplied by the reciprocal of the CO_2 percentage, to give a factor approx. proportional to the loss of efficiency in the furnace. Cf. C. A. 22, 4280.

Rotating gas-producing furnace. HUMPHREYS & GLASGOW, LTD., and ARTHUR GRAHAM GLASGOW. Ger. 481,245, April 16, 1926. Details of construction.

Battery of horizontal coke ovens. GEORGE T. BRUUN (to Koppers Co.). U. S. 1,730,602, Oct. 8. Structural features.

22—PETROLEUM, LUBRICANTS, ASPHALT AND WOOD PRODUCTS

W. F. FARAGHER

Constituents of wood spirit and acetone oils. IV. H. PRINGSHEIM, A. SCHREIBER, A. BEISER, W. DOSTER, H. LOOFMANN, G. POJARLIEFF, B. ROSEN and E. STEINITZ. *Cellulosechemie* 8, 45 66(1927); cf. C. A. 19, 240, 3087; 22, 682.—The following compds. were isolated from the water-sol. portion of the wood spirit light oil (I): Me_2CO , glycol diethyl ether, allyl alc. and crotonyl alc.; from the water-sol. portion of the wood spirit heavy oil (II): Me_2CCHO , MeCOEt , glycol diethyl ether, isovaleraldehyde and methylcyclopentanone; from the fraction b. $135\text{--}50^\circ$ (III): α -methyl-, dimethyl- and trimethylcyclopentanone (?) and 1,2,4-trimethylbenzene; and from the acids (esters) and lactones: n -methylvalerianate, α -hydroxybutyric acid, caproic acid, enanthic acid, the lactones of the acids $\text{C}_{11}\text{H}_{20}\text{O}_4$ and $\text{C}_{11}\text{H}_{22}\text{O}_4$, valerolactone, a lactone of the compn. $\text{MeCH}_2\text{CH}(\text{C}_6\text{H}_{11}\text{O}_2)$, α -methyl- Δ^6 -hexenoic acid, Δ^6 -heptenoic acid and lactones of the compn. $\text{C}_{14}\text{H}_{24}\text{O}_2$ and $\text{C}_{17}\text{H}_{30}\text{O}_2$. The following were isolated from the light oil of the acetone oil: Me_2CO , MeCOEt , MeCOPr , MeCO-iso-Pr and EtCOPr ; from the heavy oil: methyl-, dimethyl- and trimethylcyclohexanone, dimethyl- and trimethylcyclohexenone, enanthaldehyde, an aldehyde of the compn. $\text{C}_8\text{H}_{14}\text{O}$, hexahydrobenzaldehyde and cyclohexylpropionaldehyde.

L. C. FLECK

The national [Italian] combustibles problem. F. CARNEVALI. *Chim. ind. agricolt. ital.* 5, 41 2(1929).—A statistical review of the present and future supply of Italian petroleum fields, particularly of the Ragusa District, which can yield about 200,000 tons of mineral oils yearly.

G. A. BRAVO

Scientific foundations of the refining of petroleum. A. E. DUNSTAN. *Fuel Science Practice* 8, 334 54(1929).—Modern petroleum refining practice is discussed under the following headings: chem. and phys. nature of petroleum, typical absorption, plant, application of natural gasoline, conversion of natural gas into liquid products, removal and recovery of S from gas, stabilization of natural gas and distn. methods. II. *Ibid* 441–56.—The refining of petroleum distillates by the following methods is discussed: soda washing, the hypochlorite process, litharge process, acid refining and the Eckmann process. The use of bauxite for the adsorption of organic S compds. and coloring matter from petroleum distillates is recommended. Exptl. data are given as proof of the verification of the Freundlich law as applied to the adsorption of S and color compds. from kerosene by bauxite. Only certain S compds. are physically adsorbed by bauxite, others, including mercaptans, are oxidized by contact with the air held in the bauxite and converted into compds. capable of being retained by the filters. D. A. R.

Novel features in Wilcox Refinery. W. T. ZIEGENHAIN. *Oil Gas J.* 28, No. 12, 40, 152(1929).—At the H. T. Wilson Refinery, Bristow, Okla., the kerosene and fuel-oil cuts from the main fractionating tower are stripped of their lightest fractions by the aid of steam superheated in the pipe still to 900°F . The light fractions are returned to the main tower. In both the main tower and the kerosene-stripping tower part of the condensed overhead stream is returned and sprayed over the top of the tower for control. The coke from cracking the fuel oil in the Dubbs unit is pulverized and sold as fast as produced.

EMMA E. CRANDAL

Anomalies in the viscosity of mineral oils containing paraffin in suspension. L.

EMANUELI AND E. DA FANO. *Giorn. chim. ind. applicata* 11, 261-3(1929).—Deviations in the viscosity of several extra-heavy mineral oils from the law of Poiseuille were due to minute paraffin particles being suspended in the oil, as was proved by making up such suspensions. A. W. CONTIERI

The relation between physical characteristics and lubricating values of petroleum oils. E. D. RIES. *Ind. Eng. Chem., Anal. Ed.* 1, 187-91(1929).—Gravity and color have no direct relation to the lubricating action of an oil. The A. S. T. M. cold test does not give the point at which flow ceases. The notion that Pennsylvania oils give a higher Conradson C test because of the presence of paraffin is disproved by comparative tests. The wax serves as a diluent and lowers the % of hydrocarbons that crack and yield C in the Conradson test. Flash and fire points are not as good indications of volatility as distn. under vacuum. By taking the ratio of viscosity at 100°F. to viscosity at 210°F. as a temp.-viscosity coeff., paraffin-base oils have a lower temp.-viscosity coeff. than naphthene-base, and the viscosity of vacuum-distd. paraffin-base oils is still less affected by temp. EMMA E. CRANDAL

Recent development in the art of cracking in the vapor phase. C. R. WAGNER. *J. Inst. Petroleum Tech.* 15, 484 92(1929); cf. *C. A.* 23, 4052.—A historical review of development in the art of cracking petroleum oils. The first attempts to crack were directed to vapor-phase processes but excessive coke and fixed-gas formation as well as the excessive furnace temp. required and the difficulty of treating the product obtained retarded the development of this type of cracking. All of these drawbacks have been largely overcome in recent years, however, and it is now possible to produce economically good yields of anti-knock gasoline by vapor-phase cracking processes. D. F. BROWN

Action of aluminum chloride on hexahydroaromatic and saturated aliphatic hydrocarbons. REGINALD STRATFORD. *Ann. combustibles liquides* 4, 83 108, 317-59(1929).—See Grignard and S., *C. A.* 18, 3110. R. E. SCHAAD

Govers process built on use of diphenyl as indirect heating medium. G. H. REID. *Refiner and Natural Gasoline Mfr.* 8, No. 10, 63 80(1929).—The Govers process, which consists of vacuum distn. of skimming plant residuum followed by extrn. of paraffin with solvents and redistn. under vacuum, makes use of diphenyl as a heating medium for the first time. Diphenyl is a solid, flaky material which m. 70°, b. 251° and is not decompd. up to 490°. Its vapor pressure is 110 lb., its sp. heat is 0.4 and its latent heat of vaporization is 110 B. t. u. at 400°. It is non-corrosive and non-inflammable. An app. is described for utilizing this heating medium. J. L. ESSEX

Various Emba crude oils. N. D. GRAMENITZKII. *Neftyanoe Khozyaistvo* 16, 516-26(1929).—The characteristics of crude oils from various fields located in the Emba area are given. A. A. BOEHTLINGK

Some notes on a portion of the Lizard Springs anticline. R. H. SKELTON. *J. Inst. Petroleum Tech.* 15, 443-55(1929).—The stratigraphy and structure in this field (Trinidad) are described. The crude oil is dark green in color, sp. gr. 0.798 to 0.815, distillate up to 150° 32-46% (sp. gr. 0.769-0.771), distillate 150-300°, 49-56.5% (sp. gr. 0.811-0.822), residue 4.5-10.5% (sp. gr. 0.903-0.905). The residue is fluid at 6°F. D. F. BROWN

The technical methods for breaking crude-oil emulsions. A. LOTTERMOSER AND NICOLAS CALANTAR. *Kolloid-Z.* 48, 179 84(1929). cf. *C. A.* 23, 5081.—A résumé of the many methods employed for de-emulsifying crude oil is given in brief. No universal method is known since emulsions behave differently as the result of previous treatment. Drilling and raising of oil, location, transportation, accessibility of emulsifiers and phys. and chem. treatment are the chief factors involved in the breaking processes. R. H. LAMBERT

Determine efficiency of absorber. E. R. COX AND M. L. ARNOLD. *Oil Gas J.* 28, No. 13, 46, 97-8, 101, 105-6(1929).—The aim of this work was to establish a relation between the ratio of oil to gas and the efficiency of absorption when wet natural gas is passed through absorption oil. A formula was derived for the relation, based on the laws of Dalton, Raoult and Avogadro. Operating data furnished by the principal companies who are making natural gasoline by absorption were used to test the formula, which, it was decided from the results, was essentially valid. The following simplification of the formula is sufficiently accurate for calcg. the oil-to-gas ratio necessary to absorb all the $n\text{-C}_4\text{H}_{10}$ from the gas which the particular type of absorber is capable of recovering: calc. or est. the temp. of the oil leaving the absorber. Multiply the vapor pressure of $n\text{-C}_4\text{H}_{10}$ at this temp. by 75, and divide by the working pressure (abs.) expressed in the same units. EMMA E. CRANDAL

Development of insulating oils. C. E. SKINNER. *Electrician* 103, 299-301(1929).—

A review. Through accident discovery was made early in the study of insulating oils that free S would greatly impair their insulating value. C. G. F.

A new method of evaluating alterability of transformer oils. H. WEISS AND T. SALOMON. *Ann. combustibles liquides* 4, 419-36(1929).—The time ("first period") required for production of a trace of deposit insol. in the oil maintained at 114-117° with the oil surface in contact with air is used as an index of the alterability. Oils are classified as *very alterable* (first period of less than 10 hrs.), of (1) *average* and (2) *slight alterability* (those yielding deposits of (1) more and (2) less than 0.008 g./100 cc. of oil in 15-24 hrs.), and *very slightly alterable* (first period of more than 36 hrs.). R. E. SCHAAD

Distribution of sulfur in oil shale. III. E. P. HARDING. *Ind. Eng. Chem.* 21, 818(1929).—The following figures give, resp., the % of S in the shale and the % of the total S that is present as sulfide, as sulfate and as organic: Sao Paulo, Brazil 0.5765, 45.81, 16.06, 38.13; Musselband Seam, Scotland, 0.8819, 65.69, 11.42, 22.89; Elko, Nev., 4.946, 72.62, 8.21, 19.17; Green River, Utah, 1.101, 37.24, 13.26, 49.50; Mount Logan, Colo., 1.373, 46.43, 6.30, 47.27. EMMA E. CRANDAL

Some experiments in burning tar from kauri waste. ARNOLD HANSSON. *New Zealand J. Sci. Tech.* 11, 53-60(1929).—The % of HOAc and MeOH was too small to make the pyroligneous liquor of com. value. The tar contained considerable H₂O, and distn. gave a low yield of oils. The dehydrated pitch was very hard and brittle and gave low yields of light and heavy oils on distn. E. M. SYMMES

Comparison of the McIlhiney and Rosenmund methods in the determination of unsaturated bonds in petrolatums. P. AGOSTINI. *Ann. chim. applicata* 19, 241-53 (1929).—The method of McIlhiney is considered better than that of Rosenmund for this purpose, because substitution products are formed, and the former method distinguishes between addn. and substitution. A. W. CONTIERI

Results of experimental work in sweating slack wax. H. L. KAUFFMAN. *Refiner and Natural Gasoline Mfr* 8, No. 9, 74-6(1929). The phys. treatment given to wax before sweating is a controlling factor. Slow cooling of melted wax before sweating is more advantageous than rapid cooling, as evidenced by higher yields with lower oil-and-moisture content. The yield of scale wax is also increased by slow cooling followed by agitation prior to sweating. J. L. ESSEX

Determination of oil in paraffin wax. D. P. WELD. *Refiner Natural Gasoline Mfr* 8, No. 10, 102(1929).—A review of the disadvantages of all previous methods is given. The A. S. T. M. has adopted as a tentative standard a modification of the old press method, but the method is good only for expressible oil and not total oil. The oil-and-wax mixt. is pressed between two cloth disks at 1000 lb. per sq. in. and 15.5°, then dried at 100° and weighed. No method for detg. the actual oil content of wax is available. J. L. ESSEX

Cup grease manufacturing methods. H. L. KAUFFMAN. *Refiner Natural Gasoline Mfr* 8, No. 9, 106-15(1929).—A large no. of formulas for mfg. cup greases, analyses of greases, characteristics of well-made greases and purchasing specifications are given. J. L. ESSEX

The valuation and cracking of gas oils. R. H. GRIFFITH. *J. Soc. Chem. Ind.* 48, 252-63T(1929).—The aim of this work was to correlate the value of gas oils for gas making with their compn. The method was to measure the thermal value of the gases produced from cracking a given quantity of oil in a stream of H₂ or N₂. A vertical silica tube into which the oil was dropped served as the furnace for the first expts. When therms per gal. of oil were plotted against cc. of oil going through per min., the curve rose abruptly to a max. and then dropped off linearly. When packing sufficient to double the exposed surface was placed in the tube, the curve obtained was somewhat dissimilar, as if the products of surface reaction were not identical with those of gas reaction. The temp. of max. efficiency in gasification was about 750°. H₂ raised the efficiency, as comparative runs with N₂ showed. The H₂ may react with gaseous or liquid hydrocarbons, it may retard the loss of H₂ from the hydrocarbons, and it may react with the products of cracking while the temp. is still sufficiently high. The oils tested were analyzed; the highest thermal yields were from those contg. the highest % of straight-chain compds. Study of tar production required the use of a somewhat larger tube as furnace. As the rate of feeding was increased, the tar yields dropped to a min. almost immediately and remained nearly const. The "paraffin" content of the tar, that is, the % of substances not dissolved by H₂SO₄, was very high at low rates of feed. The pitch or residue after distn. of the tar to 360° increased with the rate of oil feed. Expts. with carburized-water-gas sets, like those with the miniature app., gave the max. of therms produced per gal. of oil while the feed rate was still low. The optimum temp.

could not be known exactly without the facts as to temp. gradient throughout the super-heater and carburetor.

EMMA E. CRANDAL

Commercial gasoline in the Argentine; criticism of analytical methods. ALFREDO D. ROZZI. *Anales oficina quim. provincia* 2, No. 2, 124-65(1929).—A critical review of gasoline-testing methods, in particular those of the U. S. Bureau of Mines, and the current methods for estg. unsatd. aromatic and naphthenic hydrocarbons. A practical aniline-point method for aromatics, etc., is outlined. The 3-hr. sulfur-corrosion test is too rigorous and should be reduced to 2 hrs. A bibliography of 74 references is given. Engler distn. curves are shown for Texas and other gasolines.

EMMA E. CRANDAL

Twentieth semi-annual motor gasoline survey. E. C. LANE, S. S. TAYLOR AND C. J. WILHELM. *Bur. Mines, Repts. Investigations* No. 2959, 12 pp.(1929).—Gasoline sold during the summer of 1929 was slightly more volatile than in 1928 (2°F. general lowering of av. distn. range). Winter gasoline was more volatile than summer fuel in the lower end of the distn. range. Six tables of analyses are given.

ALDEN H. EMERY

Analytical reactions of tetraethyl lead. GRAHAM EDGAR AND GEORGE CALINGAERT. *Ind. Eng. Chem., Anal. Ed.* 1, 221-2(1929).—Pb in concd. or dil. gasoline soln. as alkyl lead is converted to bromide and then detd. either gravimetrically as chromate or volumetrically by the molybdate method. R_4Pb ($R = C_2H_5$), R_6Pb_2 , R_3PbX and their mixts. are detd. by an iodometric method.

ARTHUR FLEISCHER

Flame characteristics of "pinking" and "non-pinking" fuels. II. G. B. MAXWELL AND R. V. WHEELER. *J. Inst. Petroleum Tech.* 15, 408-15(1929); cf. *C. A.* 22, 3038.—As a result of a study of the flames of explosions of mixts. of isopentane, pentane, benzene and other fuels with air in a closed horizontal cylinder it is concluded that 2 conditions are necessary for a "pinking" explosion to occur in a closed vessel. (1) The size and shape of the vessel, the nature and strength of the mixt. and the magnitude and rate of heat liberation in the burning gases must be such that a stationary wave can be set up in the column of gases before the initial flame has traveled throughout the vessel. (2) The nature of the fuel and its concn. in the mixt. must be such that there is sufficient residual energy available to maintain a shock wave when the flame, accelerated by the stationary wave, is arrested by the wall of the vessel. With these assumptions the effect of addn. of "antiknocks" such as $Pb(C_2H_5)_4$ which render the combustion continuous behind the flame front is understandable. Fuels like C_5H_8 and CS_2 , which themselves burn continuously during explosion, act in a manner similar to $Pb(C_2H_5)_4$, but less effectively. The effect of turbulence is probably two-fold. It tends to prevent formation of a stationary wave and it accelerates the combustion in the wake of the flame.

D. F. BROWN

Methods of determination of aromatic hydrocarbons in gasolines produced by straight distillation. M. D. TILICHEEV AND A. I. DUMSKII. *J. Inst. Petroleum Tech.* 15, 405-83(1929); cf. *C. A.* 22, 1674.—Four methods for determining the aromatic content of gasoline are described—(1) The aniline method, (2) the nitrobenzene method, (3) the sp. gr. method and (4) the refractometric method. For the C_6H_6 , C_7H_8 and C_8H_{10} fractions the refractometric method appears to be the simplest and quickest. The method is accurate to $\pm 0.3\%$. For greater accuracy the sp. gr. method is preferable. The aniline or nitrobenzene method should be used for detg. aromatic hydrocarbons in the 150-200° fraction, since the variable compn. and structure of the aromatic hydrocarbons in this fraction do not affect the crit.-soln. temp. as much as they do the sp. gr. or refractive index. The sp. gr. and refractometric methods therefore can be successfully applied only to fractions boiling below 150°. The nitrobenzene method has the following advantages over the aniline method: (1) lower crit.-soln. temp. and therefore more rapid detn., (2) smaller fluctuations of nitrobenzene coeffs. because of the non-aromatic portion, and (3) greater soly. of nitrobenzene.

D. F. BROWN

Economical use of steam in gasoline plants. W. L. RIFENBERICK. *Refiner and Natural Gasoline Mfr.* 8, No. 9, 88, 90, 94, 96, 98, 100, 102, 104(1929).

J. L. ESSEX

Diesel-fuel-oil specifications. HENRY C. DINGER, et al. *Mech. Eng.* 51, No. 10, 765-8(1929); cf. *C. A.* 22, 4783.—In this progress report of an A. S. M. E. Comm. the suggested requirements as they now stand are, for heavy-duty and light, high-speed engines, resp., max. viscosity at 100°F., 200 sec., min., 45 sec., max. 100 sec.; S, max., 3%, 2%; Conradson C, max., 5%, 1%; ash, max., 0.08%, 0.02%; flash, min., 150°F.; moisture and sediment, max. 1%, 0.5%.

EMMA E. CRANDAL

Viscosity of Diesel-engine fuel oil under pressure. MAYO D. HERSEY. *Natl. Advisory Comm. Aeronautics Tech. Notes* No. 315, 8 pp.(1929); cf. *C. A.* 22, 2052.—It is necessary to know the effect of the high pressure upon the viscosity of fuel oil to be injected into Diesel-engine cylinders. Detns. of viscosity of a Diesel fuel oil, sp. gr. at 20° 0.864, were made in the ball- and slanting-tube app. used for the work described in *C. A.*

22, 2052. The fuel oil was less viscous than the lubricating oil previously tested; hence a larger ball was used, with smaller radial clearance. This lengthened the roll time and made possible greater accuracy of readings. The finding of the abs. viscosity is based on the equation $ST = U/S$. S = the sq. root of the ratio of density of ball to density of oil, minus 1. T is roll time. U is the kinematic viscosity, or the abs. viscosity divided by density. The density of the oil can be calcd. as a function of temp. and pressure. A calibration curve for which ST was plotted against U/S was obtained for the viscometer by detg. the roll times for five liquids whose viscosity at atm. pressure was known; MeOH, H_2O , kerosene, the Diesel fuel oil and a white mineral oil. Roll times for the fuel oil could then be taken for pressures up to 12,000 lb./sq. in., and abs. viscosity found from the chart. At 22.6° the abs. viscosity of the fuel oil rose from 0.0563 poises at atm. pressure to 0.284 at 12,000 lb. pressure. Isopiestic were plotted over the temp. range 20° to 120°; and isothermal curves for pressures up to 12,000 lb.

E. E. C.

Gilsonite and related bitumens. I, II. H. M. LANGTON. *Ind. Chemist* 5, 324-6, 383-6(1929).—The properties of the natural bitumens are classified. L. confines the article otherwise to the asphaltites (gilsonite, glance pitch, grahamite and manjak). Part I describes the occurrence and mining of gilsonite in Utah. Part II discusses the effects of shipping practices on gilsonite, its grading into "selects" and "run-of-mine," the properties of these 2 grades, and the uses of gilsonite in the manuf. of paints, varnishes and japans, in elec. insulation and in ink manuf. The occurrence, properties and uses of glance pitch, grahamite and manjak are covered in moderate detail. Bibliography.

E. G. R. ARDACH

The bituminous sandstone of Pointe-Noire (French Equatorial Africa). V. BABET. *Ann. combustibles liquides* 4, 65-8(1929).—On extrn. by C_6H_6 and $CHCl_3$ the sandstone yields 15.5 and 16%, resp., of bitumen, d. 1.053, m. 48°. Slow distn. of the bitumen with $ZnCl_2$ gives 62% by wt. of liquids and a residue of C.

R. E. SCHAAD

Determination of the flash point of lubricating oils. JOSEF ŽD'ARSKÝ. *Chem. Obzor* 4, 219-20, 252-9(259 English)(1929).—Agreement with results obtained by using the Marcusson app. can be obtained by an app. provided with an ignition device with a small horizontal flame which when the burner is turned down comes within the crucible rim. The following precautions must be observed: a porcelain or metallic crucible 40 mm high and of 40 mm. diam inside is filled with cylinder oil up to a mark 15 mm. below the rim, or, with other oils, up to a mark 10 mm. below the rim; the app. is then fixed in the center of the app., clamped, and surrounded by coarse sand up to the level of the oil surface. Heating should be so regulated as to obtain a regular increase of temp. of approx. 2-3° per min. in the neighborhood of the flash point. The small flame must be adjusted to a length of 10 mm. The oil should be tested at intervals of 1°. The thermometer used should be standardized.

JAROSLAV KUČERA

Carbon deposits from lubricating oils. Experiments with heavy-duty engines. C. J. LIVINGSTONE AND W. A. GRUSE. *Ind. Eng. Chem.* 21, 904-8(1929).—Trials of a paraffin-base oil giving normally high Conradson C residue, a highly refined paraffin-base oil of low C residue, and a naphthene-base oil, were made in a fleet of sleeve-valve motor-coach engines. The results were studied in conjunction with previous C-residue tests upon oils in a poppet-valve lab. engine. Conclusion: While the C-residue test answers for paraffin-base oils to be used in poppet-valve engines, a better requirement for oils to be used in a sleeve-valve engine would be a distn. standard. For instance, it might be specified that 90% of a naphthene-base oil be volatile at 10 mm. pressure and distil over between 550° and 750°F.

EMMA E. CRANDAL

Reaction between lubricating oils and phosphorus pentoxide. C. C. FURNAS. *Ind. Eng. Chem., Anal. Ed.* 1, 185(1929).—Yellow P was used to exclude air from a system in which heat-transfer expts. were being made. P_2O_5 dust formed reacted with the lubricating oil on the vanes of the blower used and formed a thick, sticky, reddish brown gum. The gum could be dissolved out in H_2O and then did not reform.

EMMA E. CRANDAL

The "wet carbonization" of wood and sulfite waste liquors. CARL G. SCHWALBE. *Papier-Fabr.* 27, 300-11(1929).—An address. A process (cf. C. A. 22, 1035) is outlined by which wood is heated to 135° in a concd. $MgCl_2$ soln. Yields obtained resp. by customary dry distn. and wet carbonization are from softwood: charcoal, 30, 55%; HOAc, 2 and 6%; MeOH, 0.6 and 1.2%; and oil — and 2%; from hardwoods: charcoal 30 and 55%; HOAc, 4.3 and 10%; MeOH, 1.5 and 1.2%. No Me_2CO is obtained in the wet process. The same process is applicable to concd. sulfite pulp waste liquors, except that bark charcoal is added to start the decompn. and also that if the sulfite liquor has been fermented and distd., the greater part of the lime must be pptd.

with H_2SO_4 . The yields obtained from 1 cu. m. of liquor are: charcoal, 70 kg.; MeOH 0.7 kg.; furfural and oil, traces. The charcoal in this case is obtained in a form which can readily be removed by filtration. The heating values of the charcoals are: wood, dry distn., 8000 cal.; wet process, 6800 cal.; sulfite liquor, 4800 cal. R. H. DOUGHTY

Glycerol index of turpentine. M. H. BARRAUD. *Mat. grasses* 21, 8514-6(1929).—An emulsion of turpentine and glycerol shows irisations when looked through in front of a luminous background (Christiansen phenomenon). A color change from blue to violet is produced on heating. The temp. of change is affected by the compn. of the turpentine. Adulterants such as C_6H_6 and MeOH also affect the temp. of change. This method is applicable only when the same types of trees are compared. P. T.

The significance of the hydrogen content of charcoals. H. H. LOWRY. *J. Phys. Chem.* 33, 1332-42(1929); cf. *C. A.* 18, 2094.—Equations are given to express results obtained on the H content of charcoals made by heating coals at temps. from 800° to 1500° for various lengths of time. The H content was not affected by the atm. in which carbonization was carried out, whether H_2 , air or CO_2 . T. H. CHILTON

Fuel efficiency tests on batch oil stills (KREISINGER, *et al.*) 21. Lubricants for paper mills (STEINITZ) 23. Oil analysis (KETTLE) 27. New petroleum by-product: octane-sultone (BALDESCHWIELER, CASSAR) 10. Hydrogenating carbonaceous materials (U. S. pat. 1,730,997) 21. Filter for oil (U. S. pat. 1,730,581) 1.

Petroleum distillation and fractionation system. EUGENE H. LESLIE and EDWIN M. BAKER. U. S. 1,730,891, Oct. 8. An app. with a fractionating column, and various details of procedure are described.

Olefins from mixed petroleum products. ROBERT M. ISHAM (to Seth B. Hunt, trustee). U. S. 1,729,782, Oct. 1. Mixed products such as oil gas are treated, at 20°, under sulfating conditions (suitably under pressure) with an acid menstruum comprising a H_2SO_4 deriv. of an unsatd hydrocarbon substantially free from active constituents other than alkylsulfuric acids, *e. g.*, with EtHSO_4 and PrHSO_4 , in order to sep. olefins. The residual gas may be further scrubbed with 93.2% H_2SO_4 at about 80°.

Treating hydrocarbons with alginic acid. LAURIE L. BURGESS (to Plastic, Inc.) U. S. 1,729,993, Oct. 1. By the reaction of alginic acid upon a hydrocarbon material such as paraffin in CCl_4 soln., a product is obtained which is suitable for use as a *waterproofing compn.*

Apparatus for distillation and condensation of hydrocarbon oils. JOHN E. BELL (to Sinclair Refining Co.). U. S. 1,730,350, Oct. 8. Various structural details are described.

Hydrogenating and purifying mineral oils, etc. MAX HOFSAß (to Internationale Bergin-Compagnie voor Olieën Kolen-Chemie). U. S. 1,729,943, Oct. 1. Mineral oils, crude naphthalene, oils from coal, etc., are subjected to the combined action of H and Na under pressure and at a temp. of at least 300°. Cf. *C. A.* 22, 3773.

Electrical heating system for oil stills. ARMAN E. BECKER and JACKSON R. SCHONBERG (to Standard Oil Development Co.). U. S. 1,730,112, Oct. 1.

Recovery of gasoline hydrocarbons from gases. WARREN K. LEWIS (to Standard Oil Development Co.). U. S. 1,730,152, Oct. 1. The gas is introduced at an intermediate point of a gas and liquid contact zone and an absorption liquid such as mineral seal oil which is substantially non-volatile under the prevailing conditions and miscible with the condensible hydrocarbons is introduced above the gas inlet and in part at least near the top of the gas and liquid contact zone; intermittent countercurrent contact of the gas and liquid is effected, and the contact zone is cooled near its top and heated near its bottom. Various structural details of app. are described.

Filter for gasoline, etc. HENRY E. PELLETIER (to Pelco Auto Products, Inc.). U. S. 1,730,475, Oct. 8. Structural features.

Strainer for gasoline or other liquid fuels. CHARLES W. FISHER (to Alomite Corp.). U. S. 1,730,360, Oct. 8. Structural features.

Lubricant. HOWARD DIMMIG. U. S. 1,729,823, Oct. 1. Pb oleate is dissolved in a mineral lubricating oil to form a liquid lubricant which is suitable for use as a "car oil," for lubricating journals, etc.

Filtering lubricating oil of internal-combustion engines. FRED W. MANNING (to Stewart-Warner Corp.). U. S. 1,729,746, Oct. 1. An app. is described comprising a magazine filter arranged for removal of contaminated filtering material in direct ratio with the introduction of new oil.

23—CELLULOSE AND PAPER

CARLETON E. CURRAN

Review of cellulose chemistry developments. J. L. PARSONS. *Paper Trade J.* 88, No. 21, 73-4 (1929).—A review of the activities of the comm. on methods of analysis of the Cellulose Division of the Am. Chem. Soc., together with a description of the method proposed by it for the detn. of α -cellulose. A. PAPINEAU-COUTURE

Characterization of celluloses. T. LIESER. *Cellulosechemie* 10, 21-7 (1929).—Innumerable natural and artificial celluloses are believed to exist each with different phys. and chem. properties, and all natural cellulose fibers to contain many chemically different celluloses; a chem. method, based on viscose formation, for their differentiation is described. At a certain sp. concn. of NaOH, which at a given temp. varies with the form of the cellulose, a compd. of the type $2C_6H_{10}O_5 \cdot NaOH$ is formed, the formation of which is characterized by the possibility of undergoing the viscose reaction. Thus, natural cotton cellulose forms this compd. only with at least 16-18% NaOH soln., while Cellulose-A (pptd. from concd. HCl soln.) requires only a 7.5% soln. There exists a whole range of intermediate celluloses which form compds., and, in consequence, undergo the viscose reaction, with increasingly lower concns. of alkali. Thus, if the % of the sample undergoing the viscose reaction is plotted against the concn. of alkali, a series of different curves are obtained with different types of celluloses. When natural cotton cellulose is treated with alkali of increasing concn., above 2 N the proportion undergoing the viscose reaction increases with increasing alkali concn. until it is complete at 5 N. Lignocellulose gives the viscose reaction at lower alkali concn., while with artificial silk the proportion of viscose formed increases rapidly at concns. of alkali above N. In the practical application of the method for the differentiation of cellulose and for the detection and detn. of Cellulose-A (which is useless for the prepn. of artificial silk), excess of alkali must be avoided, just sufficient being added to 1 g. of the cellulose to moisten all the fibers. After 1 hr. at 21°, 0.5 cc. of CS_2 is added and the viscose formation allowed to proceed in the thermostat. After diln. with water the insol. residue is filtered through a hardened paper and washed until the filtrate gives no ppt. with mineral acids. The residue is then washed with 0.5 N HCl, dried at 103° and weighed. A number of typical results with various types of cellulose are given. B. C. A.

Substances accompanying cellulose. I. F. W. KLINGSTEDT. *Biochem. Z.* 202, 106-14 (1928).—Cellulose preps. (sulfited cellular material of pine wood) can be completely freed from pentosans by treatment with sufficient 17-18% NaOH for 1 hr. With 6% NaOH, the first treatment of crude cellulose removes about half of the pentosans, and 90% is removed by 2 treatments. Saturated baryta at 50° removed only about one quarter of the pentosans. The cellular material obtained from rye straw by successive chlorinations contains large amts. of pentosans, which can be removed by treatment with 17% NaOH. B. C. A.

Tensile strength and elongation of continuous cellulose fibers. JAN KALFF. *Rec. trav. chim.* 48, 997-1004 (1929).—Samples of viscose and cuprammonium fiber were tested for tensile strength and breaking elongation on a machine of the Schopper type. Details of methods are not given, though representative data are submitted to show that the detn. should be carried out at a speed such that max. strength is obtained. The speed of the machine should be indicated in terms of percentage extension per mm. The breaking elongation of viscose is independent of the duration of the detn., while the cuprammonium fiber shows a higher elongation the greater the speed of the Schopper machine. Shorter's theory of the compn. of wool fibers (cf. C. A. 18, 2253) is applied to artificial silk. S. B. FOSTER

Determination of cellulose and amount of chlorine consumed in its isolation. MARK W. BRAY. *Ind. Eng. Chem., Anal. Ed.* 1, 40-3 (1929).—A new modification of the Cross and Bevan method utilizing a simplified type of Roe's app. (cf. C. A. 18, 2808) is described. The method offers more rapid and complete chlorination, less degradation of the cellulose, and elimination of the factor of particle size. F. A. S.

Determination of α -cellulose. GRO. J. RITTER, et al. *Ind. Eng. Chem., Anal. Ed.* 1, 52-4 (1929).—Four methods were compared by the A. C. S. Committee and one recommended as standard. Details of each method are given. F. A. SIMMONDS

The determination of α -cellulose. ERWIN SCHMIDT. *Papier-Fabr.* 27, 249-51 (1929). The effect of diln. after mercerization, and of washing with 8% NaOH, has not been sufficiently emphasized. The temp. of the wash soln. is more important than that of the mercerizing soln. The time of washing must be accurately controlled, since

the α -value decreases rapidly with increased time (cf. Bergqvist, C. A. 23, 3079).

R. H. DOUGHTY

The determination of α - and β -celluloses. RAGNAR BERGQVIST. *Papier-Fabr.* 27, 119-23; *Pulp Paper Mag. Can.* 28, 515-6, 548, 550(1929); cf. C. A. 22, 1678; 23, 3079.—Experience with the Jentgen method (cf. Schwalbe, C. A. 22, 4800) indicates that this should not be considered as one affected by large exptl. errors; by proper and careful manipulation results checking within 0.1% should be consistently obtained. Representative data are cited leading to the following recommendations: (1) A sample of 10 g. should be used, as this will be more truly representative than a smaller one; weighings should be carefully made, and the drying oven accurately controlled. (2) The mercerization should be carried out at 20°; if a thermostat is not available a correction of 0.1% per degree should be applied to the α value, being subtracted if the temp. is above 20° or added if it is below this value. The same correction applies in the opposite sense to the β value; the γ value is independent of the temp. The wash water in any case should be kept close to 20°. (3) The amt. of water used for diln. should be kept const. at 300 cc. (4) Filtration must be begun at once after diln., and completed as rapidly as possible; by using a linen cloth filter in a Buchner funnel filtration and washing may be completed in 5 to 10 min. (5) Mech. treatment (kneading, of fiber with mercerizing soln.) should be brief, not exceeding 5 min. Immediate and rapid filtration and washing is by far the most important single factor. Thus, parallel samples were treated with 50 cc. and 200 cc. of mercerizing soln. When treated as under (4), the α values were, resp., 87.36 and 87.30%, while, when a 5 min. interval intervened between diln. and filtration, they were 87.38 and 86.32%.

R. H. DOUGHTY

Celluloses of some Australian plants. WILLIAM G. ARNEMAN AND JOHN C. EARL. *J. Proc. Roy. Soc. N. S. Wales* 63, 44-6(1929).—Celluloses from all sources are not identical since acetylated celluloses from 2 woods, 5 water and 1 saline plant had optical rotations ranging from $[\alpha]_D = -20.1^\circ$ to $[\alpha]_D -39.9^\circ$. One was optically inactive.

F. A. SIMMONDS

Cellulose from cereal straws. S. D. WELLS. *Ind. Eng. Chem.* 21, 275-8(1929).—Pure pulps in high yield can be produced from cereal straws by relatively mild chem. treatment. The use of dil. NaOH, Na_2CO_3 with and without S, $\text{Ca}(\text{OH})_2$ and Cl_2 with wheat straw is described. Fifteen % of xylan can be extd. from straw with dil. NaOH and 9% of furfural-yielding compds. by chlorination followed by NaOH extn. The spent cooking liquors from Na_2CO_3 -S cooking yield lactic acid, AcOH, etc., on hydrolysis, fermentation, etc.

C. E. CURRAN

The estimation of cellulose in wood. J. H. ROSS, A. L. DAVIDSON AND R. O. HOUGHTON. *Pulp Paper Mag. Can.* 27, 925-6(1929).—The method is based, like the Cross and Bevan method, on chlorination of the non-cellulose constituents and on soln. of the chlorination products in an alk. soln.; HClO is used instead of Cl gas, and NH_3 water instead of Na_2SO_3 soln. The proposed method of procedure is described in detail. The cellulose thus obtained is not a pure cellulose but is equiv. to the type and amt. obtained from wood chlorination with Cl gas. To est. the resistant cellulose, reflex the residue with 1% NaOH soln. for 1 hr., wash with water, AcOH and water, dry and weigh. The method may be modified to include either extn. with 1% NaOH for 2 hrs. at water bath temp., or extn. for 6 hrs. with 1% NaOH at the b. p. prior to chlorination. When applied to purified cotton cellulose the method produced no loss of cellulose and only an insignificant reduction in resistant cellulose.

A. P.-C.

A standard method for determining the viscosity of cellulose in cuprammonium hydroxide. E. K. CARVER, et al. *Ind. Eng. Chem., Anal. Ed.* 1, 49-51(1929).—The method and app. are described in detail. A falling sphere viscometer and a special viscosity pipet for high and low viscosities, resp., are used.

F. A. SIMMONDS

Effect of chemical agents, especially oxidizing agents, on the behavior of cellulose. P. WAENTIG. *Cellulosechemie* 10, 81-5(1929).—Cellulose isolated from natural fibers, compared with purified standard cotton, shows a diminished resistance to chem. attack due to insufficient removal of impurities and unavoidable chem. attack on the cellulose, though improvement in the purification processes results in more resistant cellulose. Chem. action differentiates the following cellulose classes: (1) purified celluloses from natural cellulose compds., (2) cellulose regenerates prepd. from cellulose esters and ethers, (3) alkali-sol. celluloses formed by strong acid action, (4) chem. degradation products of cellulose having new chem. properties. In addn., the following phys. characteristics in the light of the micellar theory may be added: Purified cellulose is characterized by a fibrous structure, distinguished by regular arrangement of anisotropic micelles of crystallites, and possesses a relatively high resistance to swelling. Swellable regenerated cellulose, is characterized by a disorientation, perhaps also by an amorphiza-

tion of the micelles, which explains its increased swelling capacity. Alkali-sol. cellulose corresponds to a comminution of the crystallites or micelles through intramol. degradation. With each disorientation or amorphization of the crystallites the intramolecular, the intramol. degradation, or both, take place. In all cases in which the particle degradation is assumed, disorientation has already proceeded and hydrolytic degradation products are present. Accordingly, the cellulose fiber is simultaneously decompd. physically and chemically, but the former to a greater degree. Particle degradation in "hydro-" and "oxycellulose" is evidenced by increased alkali soly. of unchanged cellulose and by decrease in the viscosity of its solns., as nitrates, xanthogenates and cuprammonium compds. Ripening of viscose is accompanied by oxidation through the absorption of atm. O and is evidenced by the typical oxycellulose particle degradation characteristics above mentioned. The presence of metals accelerates the ripening of viscose because of the fact that they act as O carriers in cellulose oxidation. NaOH has no effect on particle comminution as shown by the effect of mercerization in which the strength of α -cellulose content of the material is not reduced. Particle comminution, which is tied up with cellulose oxidation, takes place in cuprammonium solns. through the catalytic action of the Cu. Xanthate solns. prepd. from cotton linters have higher viscosities than those prepd. from pulp. Although this has been explained by assuming that the linters have a higher "micelle mol. wt." than pulp, the influence of outside agencies included in the method of isolation, bleaching or purification may explain the difference. W. further discusses the effect of mech. action, such as beating or cutting of the original cellulose, on the viscosity of its viscose or nitrate solns. and on the changes in valence due to oxidation.

L. C. FLECK

Oxidation of alkali cellulose by aging and its importance in the manufacture of rayon. G. KITA AND I. SAKURADA. *Cellulosechemie* 10, 113-20(1929).—Alkali celluloses aged in the steeped and in the pressed-out condition are compared. Although both are oxidized by the action of air the oxidation products in the steeped material are dissolved by the NaOH and removed, whereas in the pressed-out material they remain in the mass and are used in the subsequent prepn. of viscose. The effects of aging for different lengths of time, of aging in an atm. of air or of H_2 , of the time of steeping, etc., on the Cu no. and spinning properties of the fibers are discussed and certain differences in spinning properties, viscosity and surface tension of viscoses obtained from alkali cellulose prepd. in different ways are described. An increase of Cu no. results on aging regardless of whether done in closed or open atm. of air or in H_2 . In general, however, there is little difference between the properties of viscoses prepd. from pressed and from steeped alkali-cellulose. In a closed atm. of air the viscosity of the viscose decreases as the time of aging or the temp. is increased, the fibers are thicker and the ripening necessary to give a spinnable product is increased. Aging in H_2 is slower than in air but the product is more viscous, spins more easily and gives stronger fibers. Under certain conditions long steeping followed by a short aging period yields fibers as strong as those obtained by aging in H_2 , and good fibers can also result by aging for a short time only in a closed atmosphere of air.

C. E. CURRAN

The oxidation of alkali cellulose with gaseous oxygen. III. WILHELM WELTZIEN AND GERHARD ZUM TOBEL. *Seide* 32, 371-7, 414-7; *Chem. Zentr* 1928, I, 2080; cf. C. A. 22, 4795.—Cotton and Cu-silk are oxidized at 60° by means of O_2 , the speed of the reaction depending upon the concn. of the alkali. A moderate concn. is best. For each atom of absorbed O approx. 1 mol. of alkali is used up. CO_2 is formed in the ratio of $1 CO_2:2O_2$. In an atm. of O_2 there is a const. increase in the alkali soly., yet the cellulose splits off no cleavage products.

C. R. FELLERS

Fractional precipitation of cellulose acetate and some properties of the fractions. J. G. McNALLY AND A. P. GODBOUT. *J. Am. Chem. Soc.* 51, 3095-3101(1929).—A sample of com. Me_2CO -sol. cellulose acetate was fractionally pptd. by addn. of dil. Me_2CO or H_2O . The fractions have the same chem. compn. but different phys. properties (m. p., viscosity); this is attributed to a difference in the state of aggregation of the glucose anhydride units in the micelles. The soly. of cellulose acetate in org. liquids is shown to be a function of its state of aggregation as well as its Ac content.

C. J. WEST

Primary and secondary cellulose acetates. H. PRINGSHEIM AND E. SCHAPIRO. *Cellulosechemie* 9, 80-2(1928).—Methods are described for converting the acetone-insol. primary cellulose acetate into acetone-sol. secondary acetate, the change being ascribed to disaggregation of the primary compd. The % yield and soly. in Me_2CO of the product obtained by heating the primary acetate with tetralin vary with the time and temp. of heating, the product being a crumbly mass. The secondary acetate is produced by shaking the primary substance in the cold, keeping it several days in

the cold or heating it with benzenesulfonic acid. Changes in AcOH content, soly. in Me_2CO , viscosity and film-forming power under different exptl. conditions are discussed. B. C. A.

Note on the work of K. Werner and H. Engelmann. "Some properties of acetone-soluble acetylcellulose." H. E. FIERZ-DAVID AND WERNER. *Z. angew. Chem.* **42**, 825-6(1929); cf. *C. A.* **23**, 4569.—Polemical. C. E. CURRAN

The behavior of cotton towards glycol and glycol-hydrochloric acid. B. RASSOW AND F. WEBER. *Papier-Fabr.* **27**, *Fest- u. Auslands-Heft*, 88-9(1929).—The α -cellulose from cotton is not attacked by heating with glycol for 37 hrs. at 190° or by 4 hrs. heating in a bomb-tube at 210° . The fibers, however, swell and become more sensitive to attack by other reagents, and the hemicelluloses and pentosans remaining after the usual purification treatment are dissolved. If small amts. of HCl are added to the glycol, these impurities are removed more rapidly, but at the same time the α -cellulose is converted to hydrocellulose. This hydrocellulose is characterized by a low Cu no., due to soln. of the impurities by the glycol-HCl. Microscopic examn. of the fibers shows that they are split in directions perpendicular to the axis. From the properties of the hydrocellulose and viscosity measurements, it appears that the glycol-HCl causes depolymerization of the cellulose mols. R. H. DOUGHTY

Storage properties of transparent celluloid. The causes and progress of its deterioration and the discrimination of samples as to stability in storage. O. C. ILLINGTON. *J. Soc. Chem. Ind.* **48**, 267-76T(1929).—Fourteen specimens of transparent celluloid of British, U. S., German, French, Swiss and Japanese manuf. were ground, and the coarse grinding (passing 0.084" hole) and fine grinding (passing 0.032" hole) were analyzed for (1) volatile matter, (2) nitrocellulose, (3) urea, (4) camphor, (5) sulfates, (6) cellulose sulfate, (7) N in nitrocellulose, (8) whether camphor was natural or synthetic, (9) viscosity in acetone + water, (10) puffing point, (11) time required for puffing at 160° , (12) small-vessel test at 100° , (13) Abel test at 82° , (14) surface acidity. The methods employed are described and results discussed at some length. The results of storage trials in a well-ventilated oven at 60° are discussed in relation to the analyses. Urea is shown to have a marked stabilizing effect on celluloid made from impure ingredients (contg. cellulose acid sulfate), but such celluloid did not with stand storage tests as well as celluloid made from well-stabilized nitrocellulose and contg. relatively little urea. Emphasis is laid on the desirability of using only pure ingredients in celluloid. Rapid tests for the discrimination of transparent celluloid as to stability are described. The behavior of celluloid during the late stages of its deterioration is discussed. E. G. R. ARDAGH

The absence of galactan in the skeleton-substance incrusting the cell wall. ERICH SCHMIDT, MATHIAS ATTERER AND HANS SCHNEGG. *Cellulosechemie* **10**, 126-34(1929).—It was previously shown (*C. A.* **21**, 1829) that in spruce and flax the hemicellulose (dissolved by 5% NaOH soln. from the cellulose-hemicellulose complex) contains no *d*-galactose, it being concluded that galactans are lacking in the skeleton-substance of these two plant cells. The present work supports this conclusion by examn. of 7 plants. That Na_2SO_3 is not a sp. solvent for *d*-galactose was detd. by substituting NaHSO_3 , resorcinol and pyridine solns., which gave *d*-galactose-free skeleton-substance. Furthermore, the material isolated at varying H-ion concns. (p_H 4.3, 6.8 and 9.2) yielded no galactose on hydrolysis. Care was also taken to eliminate auto-fermentation. Details of methods of prepn. and analysis are given, and numerous references, especially relative to fermentation as a means of identifying sp. sugars. OSCAR T. QUIMBY

Action of alkali and carbon disulfide on xylan. E. HEUSER AND G. SCHORSCH. *Cellulosechemie* **9**, 93-100(1928).—Treatment of xylan with 4-14.5% NaOH soln. and pptn. and washing the Na compd. 3 times with 20 cc. of 96% alc. (cf. Karrer, *C. A.* **16**, 644) yield an alkali xylan contg. the same proportion of Na; the value closely approximates that required by the compd. $(\text{C}_6\text{H}_5\text{O}_4)_2\text{NaOH}$, the alkali being detd. by titration or, for more trustworthy results, as Na_2SO_4 . Further washing with 96% alc. reduces the Na content since the compd. decomposes: $(\text{C}_6\text{H}_5\text{O}_4)_2\text{NaOH} \rightleftharpoons (\text{C}_6\text{H}_5\text{O}_4)_2 + \text{NaOH}$. In the case of cellulose a compd. contg. the theoretical proportion of Na is formed only with alkali concns. between 15 and 30%; at lower concns. the proportion of Na in the product increases with increasing concn. of NaOH soln. employed. Washing the alkali xylan with water causes a rapid decrease in the Na content, while with varying concns. of alc. the loss of alkali is more rapid the more dil. the alc., the Na content tending to reach an equil. value. Washing with MeOH or glycol gives results intermediate between those obtained with water and alc. A resinous product is obtained by the action of cold alc. on xylan treated with 20% NaOH, or of alc. at 70° on xylan treated with 12% NaOH soln. Similar treatment of xylan with

Na_2S soln. and washing until the filtrate is free from S give a product, the Na and S content of which varies according to the concn. of the alkali sulfide soln. used. With KOH the theoretical compd. is obtained only with more concd. alkali (8–12%), and then, like the Na compd., the K content decreases if washed more than 3 times with alc. The Li compd. is more stable and requires 10 washings to remove the excess of alkali, while the Rb compd. is stable only to 4 washings. Treatment of the unwashed alkali xylan (contg. excess of alkali) with CS_2 yields a "xylan viscose," the viscosity of which, unlike that of cellulose viscose, decreases only slightly with time and is not coagulated after keeping for 1 mo. A product free from combined Na and S compds. is obtained by neutralizing the "viscose" with dil. AcOH , pptg. and triturating the product with alc., washing with ether and drying over P_2O_5 . The proportion of S in the product so obtained varies slightly with the period of treatment with alkali and CS_2 , but is always much lower than that required by any of the possible cellulose xanthates, and, moreover, the proportion of Na and S present is less when xylan free from Cu salts and ash is used. Hence, the formation of "xylan viscose" does not depend on xanthate formation, but involves merely a dissoln. of Na and S compds. in the xylan. The action of alkali on xylan involves a chem. (hydrolysis) and not a phys. degradation, since the proportion of xylan in the "viscose" compd. detd. as furfuraldehydophloroglucide is much less than that estd. from the C content detd. by oxidation with $\text{K}_2\text{Cr}_2\text{O}_7$ and H_2SO_4 . Xylan regenerated from the "viscose" obtained by long standing with alkali and CS_2 has a lower C and a higher H content than the original xylan. *Ibid* 109–19.—The trustworthiness of 2 methods for the detn. of C, (1) oxidation with chromic and phosphoric acids and direct measurement of the vol. of CO_2 evolved (cf. Berl and Innes, *C. A.* 3, 2149), (2) oxidation with an excess of $\text{K}_2\text{Cr}_2\text{O}_7$ and H_2SO_4 and detn. of the excess $\text{K}_2\text{Cr}_2\text{O}_7$ by titration, was tested on pure Na oxalate. In this case the former method gave better results, but with xylan the results obtained by this method varied as much as 10% from the theoretical value. Better results (2% error) are obtained, in the case of xylan, by the titration method when the following conditions are fulfilled: The xylan is oxidized with 33.3–66.6% excess of $\text{K}_2\text{Cr}_2\text{O}_7$ soln. (90 g. p. 1.) in a soln. contg. 20–25 vol.-% of concd. H_2SO_4 with addn. of several drops of Hg by heating for 3–5 min. After cooling, an excess of ferrous ammonium sulfate soln. is added and the excess titrated with 0.1 N KMnO_4 soln. B. C. A.

Degree of swelling of hydrated cellulose (artificial silk). O. FAUST. *Cellulosechemie* 9, 74 5(1928).—Changes in the length of artificial silk fibers on immersion in water and in NaOH solns. show that the degree of swelling decreases with increasing temp., the difference being greater the higher the concn. of NaOH. The degree of swelling, as detd. by length measurements, is lower in H_2SO_4 solns. than in water. B. C. A.

The chemistry of viscose. G. KITA AND R. TOMIHISA. *Cellulosechemie* 10, 134–41 (1929); cf. *C. A.* 23, 5039–40.—The following reactions take place simultaneously in the formation and ripening of viscose: (1) formation of xanthate by the action of CS_2 on alkali cellulose; (2) formation of Na_2CO_3 and Na_2CS_3 by the action of CS_2 on free alkali. It is probable that the first reaction product is not as stable as the second, and as CS_2 and NaOH are consumed, xanthate, which has formed, is decomposed. The reaction continues until an equil. between xanthate, Na_2CO_3 , Na_2CS_3 , etc., is established and all NaOH is consumed. The viscose coagulates by the accumulation of the salts which are formed. Increasing the temp. favors NaOH and CS_2 consumption. Accordingly, xanthate formed at higher temp. decomposes more quickly. The reason for spontaneous coagulation of viscose has not been well understood and Cross and Bevan's theory that coagulation only takes place when xanthate has broken down to contain $\frac{1}{2}$ mol. CS_2 and NaOH to 1 mol. $\text{C}_6\text{H}_{10}\text{O}_4$ has been commonly accepted. These facts do not stand in the case where 18% NaOH soln. and 50% CS_2 are used. Coagulation does not depend on the compn. of xanthate but is caused by the disappearance of free NaOH. Viscose coagulates when its xanthate contains 0.5 mol. combined alkali. Cross and Bevan, Ost, Wyss and others hold that the xanthate first formed gradually decomposes into CS_2 and NaOH. K. and T., however, find that the formation of Na_2CO_3 and Na_2CS_3 does not always take place as a result of xanthate decompn. Xanthate is formed at low temp. Only decompn. of xanthate is observed at room temp. Accordingly, it is not rational to assume that completely formed xanthate is a compd. of 1 mol. NaOH and CS_2 to $\text{C}_6\text{H}_{10}\text{O}_4$. The investigations show xanthate decompn. on ripening and do not explain ripening only by colloidal changes. By using larger amts. of NaOH and CS_2 than specified in the Cross and Bevan process, the alkali combined in xanthate can be increased above $\frac{1}{2}$ mol. In one case 0.8 mol. was combined. L. C. FLECK

* Attempts to cheapen rayon by wet treatment. W. A. DYES. *Kunstseide* 11, 187-93, 217-25(1929).—A review of recent patents. FREDERICK C. HAHN

Chemical composition of wood in relation to physical characteristics—a preliminary study. H. E. DADSWELL AND L. F. HAWLEY. *Ind. Eng. Chem.* 21, 973-5(1929).—Tough and brash specimens of Douglas fir of approx. the same sp. gr. with no apparent structural differences showed only slight divergences in chem. compn., the lignin content of the brash sample being higher than in the tough. In white oak the differences were pronounced, *viz.*, much less Cross & Bevan cellulose and more lignin in the brash sample. Compression wood, "Rotholz," of Sitka spruce, which showed brash failures in cross-bending tests contained also distinctly more lignin and less cellulose than normal wood. Furthermore, compression wood of redwood had, in discrepancy with normal conditions, higher lignin content in the summerwood than in the springwood. The results are as yet insufficient to draw any definite conclusion on the relations between chem. compn. and phys. properties. J. WIERTELAK

The problem of future wood supply. W. SCHMID. *Papier-Fabr.* 27, 69-73(1929).—Careful forest management, release of wood now used in building trades by substitution of metals, and utilization of fast-growth tropical woods may serve ultimately to relieve the threatened pulp-wood shortage. R. H. DOUGHTY

The utilization of cheap and waste woods. C. G. SCHWALBE. *Papier-Fabr.* 27, 523-4(1929).—General. The conception of "waste" wood varies in different industries; most wastes can be utilized for some form of product by the pulp-producing industries. R. H. DOUGHTY

The methoxyl content in the lignin and cellulose decomposition of wood. RICHARD FALCK AND WERNER COORDT. *Ber.* 61B, 2101 6(1928).—The —OMe and lignin contents of pine affected with red rot, "corrosion" in pine beams having dry rot (*Merulius rot*), and "destruction" of various stages were detd. The —OMe content (% by wt.) of wood with no and with various degrees of red rot was practically const., whereas increased stages of dry rot caused increased %'s of —OMe. Detns. of the —OMe contents of the woods after extn. with alc-benzene mixt. (1:1) and of the exts. showed that with increasing stages of red rot there was a very slight decrease of —OMe in both the wood and ext., while with increasing stages of dry rot there was an increase of —OMe in both the wood and ext. in % by wt., but a decrease in —OMe in the wood in % by vol. Assuming that alc-benzene extd. wood contains only lignin bound —OMe, the —OMe contents of the extd. wood and isolated lignin should correspond. However, since the —OMe content of the lignin obtained by Urban's method was about 6% lower than that from extd. wood except in the case of bad dry rot, when it was only about 3% lower, 3 kinds of lignin are distinguished; (1) lignin in sound, red-rotted and slightly dry-rotted wood, (2) lignin in badly dry-rotted wood and (3) lignin isolated by Urban's method. C. E. H.

Heartwood of the pine. I. Adsorption and infiltration experiments with sapwood and heartwood of pine and spruce. C. G. SCHWALBE AND A. AF EKENSTAM. *Cellulose-chemie* 10, 1-11(1929).—The expts. included measurements of the rate and amt. of adsorption of water vapor and of infiltration of water and various solns., and were designed particularly for comparison of the heartwood and sapwood of the woods examd. The pine heartwood in all cases absorbed less liquid than the other samples. In infiltration expts. with both pine and spruce the absorption of water by the green sapwood was greater than that by the green heartwood, but with increasing dryness the two values converged. Pine heartwood absorbed more NaOH than spruce heartwood, but this difference disappeared when the former had been extd. with ether. In pine heartwood the Na salt of the ether sol. acid is formed, and partly retained by the wood. In sealed tubes at 110° pine heartwood showed no difference in ability to take up liquid, but it differed particularly in absorbing Mg^{++} ions to a relatively larger extent than HSO_3^- ions from $Mg(HSO_3)_2$ soln., so that the compn. of the absorbed salt corresponded to that of a neutral sulfite. This, which is the chief cause of the failure of acid disintegration processes, is ascribed to comparatively slow diffusion of HSO_3^- ions, while the Mg^{++} ions appear to react with an acid of high mol. wt. in the wood. II. Extraction by organic solvents and alkalies. *Ibid* 10, 11-8.—The amts. extd. by ether were in the order: pine heartwood > pine sapwood > spruce heartwood > spruce sapwood. Since pine sapwood can be disintegrated by the usual processes, failure in the case of heartwood is considered to be due to a difference in the nature rather than in the amt. of resinous substances present. Examn. of the ether exts. showed that pine sapwood contained a larger proportion of fats (sol. in light petroleum) than the heartwood. The similarity of acid values indicated the presence of an acid of high mol. wt. in pine heartwood. The amt. extd. by ether from pine heartwood decreased with time of storage, the fats decreasing most rapidly. Again, the residues obtained by evapn. of the

exts. became insol. when heated or kept. These effects are explained by pptn. of col-loidal constituents. Benzene extd. smaller amts. from pine heartwood than ether, but alc. extd. larger amts., including the fraction which had become insol. in ether on storage. Pine heartwood yielded the largest amt. of ext. with 1% NaOH soln., and this was largely pptd. by HCl. The ppt. was extd. with alc., and the alk. soln. fractionally pptd. by acid. Similar results were obtained with pine heartwood and sapwood. Large amts. of very weakly dissociated acids were present, and an acid with an insol. Ca salt was isolated. Spruce, on the other hand, when similarly treated, yielded acids which were more strongly dissociated and pptd. within narrower limits of H-ion concn. Comparison of the ether exts. of the substances pptd. from the NaOH exts. of pine heartwood and sapwood showed that the former contained a quantity of acid with a sol. Ca salt which was lacking in the latter. Carbohydrates, compds. contg. N or S, or tannins could not be recognized in the ext. of pine wood by 1% NaOH. **III. Heating in sealed tubes.** *Ibid* 10, 27-34.—The effect of drying, of extn. with org. solvents and alkali, and of previous impregnation with the various exts. on the isolation of cellulose has been studied in detail with standard sealed tube heating in an attempt to elucidate the nature of the material present which inhibits the decompn. The main results are as follows: The yields of cellulose obtained by heating spruce heart- and sapwood, and Scottish pine sapwood with $\text{Ca}(\text{HSO}_3)_2$ (1% CaO, 4.05% SO_2) are, resp., 46.8, 46.0 and 48.2%, while under the same conditions the heartwood of Scottish pine is completely unattacked. Previous extn. of the latter with ether, C_6H_6 or Me_2CO before the bisulfite heating gives either no yield or only a poor quality pulp, but pre-extn. with alc. yields a good cellulose (Cf. Hägglund, *C. A.* 22, 4805). If the wood is previously air-dried or, better, dried at 105° for 40 hrs. and then ether-extd., bisulfite treatment then gives, resp., 57.8 and 64.5% yields of good cellulose. The decompn. depends on the impregnability of the wood with bisulfite, and complete drying renders the wood more permeable to the ether, allowing the more complete removal of the ether-sol. portion. When the pine heartwood is previously treated for 10 days with 0.1 N NaOH and then washed with cold water for 3 days, the bisulfite treatment yields 66.2% of cellulose (ash 1.28%). Further washing for 10 hrs. with hot water gives a 65% yield (ash 0.979%), while a final washing with 0.5% AcOH for 1 hr. and water for 2 hrs. gives a 63.4% yield (ash 0.491%). Although the substance which inhibits the bisulfite decompn. is readily removed from shavings with alkali, the use of the latter is not practicable with larger pieces used technically. Similar pretreatment with $\text{Ca}(\text{OH})_2$ soln. yields specimens from which the Ca cannot be removed by washing and which contain about the same amt. of Ca as is found after heating with $\text{Ca}(\text{HSO}_3)_2$. Subsequent heating with H_2SO_4 (2.5-3.5% SO_2) causes no decompn. From a study of the effect of impregnating the pine and spruce sapwoods with the various org. and alkali exts. of the pine heartwood on the bisulfite decompn., it is concluded that the substance which inhibits the bisulfite decompn. is acidic, forms a sol. Ca salt, is sol. in alc., C_6H_6 , Me_2CO and ether, and is insol. in light petroleum. The $\text{Ca}(\text{OH})_2$ ext. of the pine heartwood differs from the spruce exts. in that it becomes turbid on acidification, and on the basis of the above properties the isolation of this acidic substance in small quantity as a viscous brown liquid is described. B. C. A.

Carbohydrate constituents of sodium hydroxide cellulose from pine wood. E. HÄGGLUND AND F. W. KLINGSTEDT. *Cellulosechemie* 9, 77-80(1928).—NaOH cellulose obtained as a 43% yield from pine wood was found to contain mannan 3.3%, pentosan 5.3%, no galactan and only a trace of levulan. After mercerization of this material with 17.5% NaOH soln. an α -cellulose was obtained which still yielded 2.1% of mannan and 1.5% of pentosan, thus differing from a similar material obtained from sulfite pulp which contained no hemicellulose. The total mannan content is obtained by first converting the material completely to sugar and then detg. the mannose present. Lignin does not interfere with the detn. of the pentosan in the cellulose. B. C. A.

The quality of spruce wood, especially regarding its use for chemical or mechanical pulp. ELIAS MORR. *Papier-Fabr.* 26, 741-7(1928).—See *C. A.* 23, 3082. R. H. D.

Variation in the lignin content of spruce wood. P. KLASON. *Svensk Pappers-Tid* 32, 494-6, 527-30(1929).—The occurrence and the probable synthesis of lignin in wood are discussed. K. considers the H_2SO_4 method for detg. the lignin content preferable to the HCl method and describes some minor improvements he has devised in the former method. The compn. of lignin is discussed. Analyses of 222 uniform samples of wood from 12 localities in Sweden gave the following lignin contents: Norbotten 28.3% from 17 samples, Västerbotten 27.8% from 7 samples, Västernorrland 28.3% from 35 samples, Jämtland 27.9% from 7 samples, Härjedalen 28.4% from 17 samples, Hälsingland 28.1% from 9 samples, Gästrikland 28.2% from 69 samples, Dalarne 27.9%

from 12 samples, Dppland 27.8% from 14 samples, Jonkoping province 27.8% from 17 samples, Kronoberg province 28.3% from 12 samples, Kristianstad province 28.0% from 6 samples, av. of 222 samples 28.1%. From this K. concludes that climatic conditions have no effect on the lignin content of spruce wood. WILHELM SEGERBLOM

The experimental pulping plant of the "Institute für cellulosechemie" of the Darmstadt Technischen Hochschule. K. G. JONAS. *Papier-Fabr.* 27, *Fest. u. Analande-Heft*, 65-70(1929).—Descriptive. R. H. DOUGHTY

Dependence of bleachability on pulping control in the Ritter-Kellner process. HERBERT NERAD. *Papier-Fabr.* 27, 277-82(1929).—It should be possible to det. a cooking coeff. (K), or parts of incrustant dissolved by 1 part SO₂ under fixed conditions, and thence to calc. Cl₂ consumption from pulping data. From this standpoint a method has been developed which after continuous use on many cooks will show the Cl₂ consumption of the pulp within $\pm 2\%$. The amt. of SO₂ actually consumed in pulping (that added in liquor less loss in relief less loss in waste liquor), and the bleachability, were first carefully detd. in 120 cooks. This study showed that the SO₂ content at 100° controlled the degree of pulping, and the time to reach 100° controlled the total time required, to a much greater extent than any other factors. On the basis of several arbitrary assumptions a method was then developed for calcg. K from the % SO₂ at 100° (a), the % SO₂ in the blow liquor (b), the no. of times the digester was relieved (Z) (in a standard manner), the bleachability value (B) by the formula $B = 50 - Kx$ where $x = (a - b) - Z(a - b)/10$. From this the relation $K = C/\log x$ was established, C being a statistical const. derived from many cooks. From this const. and the detd. values of a and b, B could be calcd. for any cook with an accuracy of $\pm 0.2\%$ Cl₂. Finally, titration was eliminated by installation in the digester of a bimetallic electrode system connected with a recording milliammeter, the throw of the meter being related empirically to a and b in the equation given. The point when the cook should be blown to give a definite bleachability could be estd. at the time 100° was reached, and variations in quality were practically eliminated.

R. H. DOUGHTY

Testing the strength of pulp. GÖSTA HALL. *Papier-Fabr.* 27, 341-7(1929); cf. C. A. 23, 3087.—The method of grading pulps on the basis of unbeaten strength is criticized, since frequently with unbleached strong pulps a series graded on this basis may be graded in exactly the reverse order if the max. beaten strength is used. The proposed official Swedish method is described and discussed. By this method the pulps are to be tested after milling to a fineness on 40-50° Schopper in the Lampen mill. It is noted that values obtained by beating for the same time in different mills may vary considerably, because of variations in dimensions. Details of the method are given, and the tests on which it is based are discussed in detail. The method was designed to give, in a rapid test, results approximating those obtained in mill operation. It is recognized that for the complete characterization of a pulp, a beating curve must be developed.

R. H. DOUGHTY

British initial pulp strength testing method. AINSWORTH HARRISON. *Paper Trade J.* 89, No. 10, 61-3(1929).—A detailed description of the method recently adopted by the Technical Section of the Paper Makers' Assocn. of Gt. Britain and Ireland for the detn. of the unbeaten strength of pulp.

A. PAPINEAU-COUTURE

Making hand sheets of uniform thickness. F. M. WILLIAMS. *Paper Trade J.* 89, No. 12, 44(1929).—A brief discussion of the importance of the construction of the supporting plate underneath the wire screen in sheet-making machines. The best form of construction, especially where uniform thickness of sheet is required, as in pulp evaluation tests, consists in making the supporting plate with rectangular openings forming a series of cross ribs, the tops of which may be dressed to nearly a sharp edge, thereby presenting practically no flat metal surface to impede the flow of water through the screen at certain points.

A. PAPINEAU-COUTURE

Viscosity measurements on pulps. ALBERT KÜNG AND ERNST SEGER. *Papier-Fabr.* 27, 433-6(1929); cf. Öman, C. A. 23, 3083.—A procedure has been developed for measurement of the viscosity by a rapid viscose method, requiring but 10 hrs. The time reduction is obtained by eliminating the ripening periods entirely. The results are high but are closely proportional to those obtained by the usual procedure, and the accuracy is satisfactory. The method is recommended for control work. A sample of pulp cut in 1-mm. squares equiv. to 0.9 g. oven-dry is weighed out, treated with 10 cc. 17.5% NaOH, pressed to a wt. of 3.0 g., xanthogenated with 0.6 cc. CS₂, dissolved in 100 cc. 1.0 N NaOH, and tested in the Ostwald viscometer. The mercerizing requires 2 hrs., pressing to weight $1/2$ hr., xanthogenation 5 hrs., soln. 2 hrs., testing $1/2$ hr. All operations are carried out at 20°, an air bath being used. Xanthogenation is done

in a specially constructed bottle mounted on a rotating device, with gaseous CS_2 , and soln. of the xanthogenate takes place in the same bottle. The original should be consulted for details of the app. and manipulation.

R. H. DOUGHTY

Conductivity and hydrogen-ion measurements (in the pulp industry). W. N. GERR. *Paper Trade J.* 89, No. 4, 51-3(1929).—It is suggested that electrometric equipment could be satisfactorily used for H-ion concn. measurements for the control of sulfite cooking, for washing sulfite pulp and for washing soda pulp.

A. P.-C.

Freeness testing as an aid in pulp evaluation. D. S. DAVIS. *Ind. Eng. Chem., Anal. Ed.* 1, 47-9(1929); cf. *C. A.* 23, 4067.—The freeness test is recommended as the most accurate of the phys. tests, adaptable to a math. treatment, to compare a no. of pulps as to phys. properties.

F. A. SIMMONDS

A new freeness and consistency tester. D. S. DAVIS. *Paper Trade J.* 88, No. 22, 42-3(1929).—A brief description of the Williams Precision Freeness Tester and discussion of its merits. With this instrument freeness-weight plots for any sulfite stock likely to be encountered in the mill are convergent straight lines, and the coordinates of the pt. of convergence are very nearly those required by the freeness theory. The same is true of the freeness-temp. plots. Complete consistency and temp. characteristics of the instrument will be published later.

A. PAPINEAU-COUTURE

Correction curves for use with the Schopper-Riegler freeness tester. KORN. *Papier-Fabr.* 27, 123-4(1929).—When the consistency of stock in the beater is not accurately known, the amt. used for a freeness test may be detd. by rapidly drying and weighing the mat of pulp from the tester. A series of curves is given by which the Schopper freeness may be corrected for any weight of sample between 1 and 4 g., the standard being 2 g.

R. H. DOUGHTY

The beater method of evaluating pulp. H. A. ROTHCHILD, A. ELY and F. POPPE. *Paper Trade J.* 89, No. 14, 72-3(1929); *Paper Mill* 52, No. 38, 10, 28, 30(1929); *Pulp Paper Mag. Can.* 28, 567-70, 584(1929).—A brief description of the equipment, procedure of testing and interpretation of results as carried out in the mills of the Kimberly-Clark Co.

A. PAPINEAU-COUTURE

Study of the causes of variations in quality during the manufacture of mechanical pulp and paper stock. JARL ENKEL. *Papier-Fabr.* 27, 498-500(1929).—A general discussion of mill expts. on a continuous grinder, in which pulp quality was judged on the basis of blue-glass test, freeness and bursting strength. The effect of decreased pressure (2.0-1.0 kg./sq. cm.) is to increase quality, the effect being more marked with a relatively hard, fine-grained stone. Increased temp. leads to increased freeness and lower power consumption, with little if any effect on strength. Natural and artificial stones if properly sharpened are of equal value. Artificial stones properly handled need little sharpening; for natural stones the quality depends less on the coarseness of the burr than on the sharpening pressure. Wood with 15 and 45% moisture content gave pulp of equal strength, and with the same power consumption; the pulp from the dry wood was much finer and gave a lower freeness value. Considered solely from the strength standpoint, a considerable infection of "red rot" in the wood is of no consequence. Rejects from the sorters are better refined by kollergang or rodmill than by the usual refiner, which gives a very weak product. Since the quality of mech. pulp is subject to unavoidable variations, it is suggested that a brief controlled processing in some continuous system such as a rodmill would be a valuable addn. to newsprint manuf.

R. H. DOUGHTY

Pulp evaluation and its adaptability to paper making. O. P. GEPHART. *Paper Trade J.* 89, No. 1, 53-5(1929).—A discussion of the tests which should be carried out on purchased pulp to det. its suitability for the purposes to which it is to be put, and of the interpretation of the results of these tests, particularly as regards strength developed on beating under the conditions existing in the purchasing mill.

A. P.-C.

Development of the sulfite pulp industry. EMIL HEUSER. *Papier-Fabr.* 27, 103-7, 417-21(1929).—An address.

R. H. DOUGHTY

Quality control in the sulfite pulp industry. A. LAMPEN. *Proc. Tech. Sec. Paper Makers' Assoc.* 9, 4-33(1929); cf. *C. A.* 22, 3294.

C. E. CURRAN

The changes of moist sulfite pulp in storage. ERNST HOCHBERGER. *Papier-Fabr.* 27, 282-4(1929).—The "isoelectric point" of sulfite pulps changes toward the acid side during storage, and apparently toward the same const. value for all pulps.

R. H. DOUGHTY

The reddening of unbleached sulfite pulps. B. RASSOW and G. BRANDAU. *Papier-Fabr.* 27, 181-7, 202-10, 217-25(1929).—The red coloration is due to the formation of an intermediate oxidation product from a substance which is present in the pulp in a colorless form, and which, on oxidation, becomes at first red and then white. The ten-

dency of a pulp to turn red depends on degree of pulping, on compn. of the cooking liquor, on washing and duration of storage. It can be removed by oxidation or by treatment with dil. mineral acids, hot water or pyridine. The extent of reddening is independent of moisture, Fe and rosin content of the pulp. The lignin content, and fluorescence of the pulp in ultra-violet light, are measures of the tendency to redden, but the red color is proved not to be caused by the lignin nor by the fluorescing substance, which latter is probably lignosulfonic acid (I). The authors believe that the reddening is caused by an absorption complex (II) of cellulose or other carbohydrates with a sort of lignosulfonic acid which is produced by chem. transformation of the lignin during sulfonation. The behavior of II during pulping is the same as that ascribed by Hägglund to I. A detailed discussion of the various theories put forward by others on this subject is included.

R. H. DOUGHTY

Determination of the Sieber chlorine-consumption number of sulfite pulps. W. HUMM. *Papier-Fabr.* 27, 387-9(1929).—One of the difficulties of detg. the Sieber no. is to prep. a soln. contg. the equiv. of 10 cc. 0.1 N alkali in a vol. contg. 0.3 g. available Cl_2 . A soln. contg. exactly 11 g. Cl_2 per l., satd. with $\text{Ca}(\text{OH})_2$ and filtered, will contain the desired quantities of Cl_2 and $\text{Ca}(\text{OH})_2$ in a vol. of 27.3 cc., which may readily be measured with a special pipet or buret. A simple slide-rule is illustrated, which shows the Sieber no. for samples of 4 to 6 g. and back titrations of 0 to 16 cc. R. H. D.

Importance of hydrogen-ion concentration in sulfite pulping. E. HÄGGLUND. *Papier-Fabr.* 27, 165(1929).—Pulp produced by use of a NaHSO_3 cooking liquor, and known to contain sulfonated lignin, was treated under standard conditions with hot H_3PO_4 - K_3PO_4 buffers of varying p_{H} values and the change in lignin content studied. The rate of soln. of the sulfonated lignin depends mainly upon the p_{H} , the amt. dissolved being greater, the greater the acidity of the buffer. These results confirm the theory that sulfite pulping proceeds in 2 stages, first sulfonation followed by soln. of the solid lignosulfonic acid. It is in the latter stage that the speed is controlled by H-ion concn.

R. H. DOUGHTY

Chemical control in the sulfite pulping process. B. RASSOW AND H. KRAFT. *Papier-Fabr.* 27, 489-95, 508-14, 524-8(1929).—Three methods of control during pulping are possible: by testing the pulp, by following the formation of lignin derivs. or by following the sulfonation process. The 2 last-named have been studied by the authors, especially the second, with satisfactory results. Samples of liquor taken at intervals during 9 cooks on wood from 3 sources were used. The α -lignosulfonic acid (A) was pptd. with β -naphthylamine-HCl (I) (cf. Klason, *C. A.* 14, 3229) and with benzidine-di-HCl (II) and analyzed, the methods and results being reported in detail. The use of II was more satisfactory in several ways than that of I. By this method 50 cc. of liquor was dild. to 100 cc., a 30-cc. portion pptd. with 20 cc. of a standard soln. of II, dild. to 100 cc. and filtered through a dry filter. A 10-cc. portion of the filtrate was treated with 30 cc. of a 5% $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ soln., the pptd. benzidine sulfate filtered and washed with cold H_2O , under suction, dissolved in boiling H_2O , and the liberated acid titrated with NaOH and phenolphthalein. From this titration the II equiv. to the A present was calcd. The soln. of II was prepd. by rubbing 40 g. benzidine with 40 cc. H_2O , transferring to a flask with 800 cc. H_2O , and making up to 1 l. after addn. of 50 cc. HCl (1.19 sp. gr.), filtering if necessary. This method was used for most of the exptl. work. On the basis of the analytical results it appeared that the ppt. obtained consisted of at least 2 compds., of which one is salted out by II, while the other is a compd. of A with II. The A going into soln. during the cook takes up more SO_2 after soln., increasing the consumption of II. Production of vanillin from the ppt. by cold oxidation with HNO_2 is in agreement with the Klason's coniferylaldehyde theory of lignin. When A as detd. by II is plotted *vs.* pulping time, it increases at first very slowly, then quite rapidly to a sharp max. value, which is maintained thereafter. In conformation to Hägglund (cf. *C. A.* 20, 3807) the first period is considered as sulfonation, the second as hydrolysis, while the third or const. period is termed the "quality period," since it is here that the quality of the pulp is detd. The 2nd period, corresponding with the true pulping reaction, starts at varying intervals after the start of the cook, depending on the source of the wood. (It should also be noted that the temp. control was different in the different cooks.) The fiber is not entirely delignified at the end of the 2nd period. That the reaction thereafter is of a different character is indicated by the constancy of A. The longer the 3rd period, the softer the pulp. In the cooks here studied this period was 1 hr. for a strong pulp and 4 hrs. for an easy-bleaching pulp. On this basis, detn. of the start of the 3rd period, by regular analysis of the liquor using the above method, which can be performed in 15 min. in the lab., is suggested as a new control method for sulfite pulping.

R. H. DOUGHTY

Sulfite liquor preparation from pyrites. HUGO LAUBER. *Papier-Fabr.* 27, 65-9 (1929).—Fineness and evenness of crushing, type of oven and presence of Cu in ore have a considerable influence on the S losses. Pyrites should be graded on the basis of S in the finished liquor, not of S in the ore. Roasting, gas purifying and absorbing equipment is described.

R. H. DOUGHTY

Production of absolute alcohol from sulfite spirit. H. KIRMREUTHER. *Papier-Fabr.* 27, *Fest- u. Auslands-Heft*, 102-6 (1929).—Difficulties in the use of sulfite spirit as a motor fuel are attributed to its water content of 4 to 5%. The technical spirit can be converted to abs. alc. by distn. with lime or with benzene. The latter process has the advantage that it may be made continuous. App. for the purpose is described.

R. H. DOUGHTY

Suggested program for a study of the pulping action of sodium bisulfite. L. J. DORENFELDT. *Papier-Fabr.* 27, *Fest- u. Auslands-Heft*, 57-64 (1929).—A general survey of the advantages of Na base for sulfite pulping, with a discussion of the requisites for its successful adoption and points which could profitably be studied. R. H. D.

Advantages of sodium bisulfite over calcium bisulfite in cooking liquors. L. J. DORENFELDT. *Paper Ind.* 11, 636-40 (1929); *Pulp Paper Mag. Can.* 28, 320-1, 350, 352 (1929); cf. preceding abstr.

A. P.-C.

Bisulfite and alkaline soda processes. JAMES BEVERIDGE. *Paper Ind.* 11, 1008 (1929).—Notes on B.'s investigations on the use of NaHSO_3 in the pulping of wood, dating back to 1890.

A. PAPINEAU-COUTURE

Straw and the monosulfite process. A. MULLER AND CO. *Papeterie* 51, 238-42 (1929).—A reply to Fournier's criticisms of the Braun process (*C. A.* 23, 3089).

A. PAPINEAU-COUTURE

The Thorne pressure process of sulfite cooking. C. B. THORNE. *Paper Trade J.* 89, No. 7, 61-2 (1929).—A description of U. S. pat. 1,691,682 (*C. A.* 23, 514). A. P.-C.

The Wolf sulfur dioxide recovery system. R. B. WOLF. *Paper Trade J.* 89, No. 5, 49-50 (1929).—A description of U. S. pat. 1,699,556 (see *C. A.* 23, 1270).

A. PAPINEAU-COUTURE

Studies on the waste (sulfite) liquor of pulp manufacture. A. HEIDUSCHKA AND E. MUNDS. *Z. angew. Chem.* 42, 11-5 (1929).—The noxious effects of waste liquor are due to the growth of *Leptomitius lacteus* and *Sphaerotilus natans*, which develop at the expense of the sugars and other org. compds. present. Typical analyses of waste liquor show that at most only 1% of the cellulose is converted to sugars during the cooking process. The liquor also contains 0.10-0.80% SO_2 (depending on the duration of the cook and type of pulp made), traces of SO_3 , 0.16-0.81% AcOH and 0.009-0.018% HCOOH . A study of the effects of various concns. of these and other compds. on the *Leptomitius lacteus* showed that SO_2 up to 0.8% had no effect while higher concns. stopped the growth or destroyed the fungus. With AcOH , HCOOH , NaOH , KOH and NH_3 , there was no effect on the fungus up to concns. of 0.04, 0.03, 0.001, 0.002 and 0.01%, resp.; the limits of growth were 0.3, 0.1, 0.05, 0.07 and 0.06%, resp.; and the limits of existence were 1.4, 0.9, 0.2, 0.3 and 0.20-0.25%, resp. With no dissolved O_2 present, growth was very slow. At temps. above 32° the fungus was killed. In sulfite waste liquor (sp. gr. 1.060) and alc. sulfite waste liquor (sp. gr. 1.13) growth of the organism began at concns. of 0.0001 and 0.001%, resp.; optimum growth occurred at 0.1 and 0.9-1.2%, resp.; and destruction at 5.8 and 10.5%, resp. By walling up the waste liquor to increase its concn. the fungi and their accompanying evils may be partially eliminated.

C. E. H.

Apparatus for concentration of waste sulfite liquors. D. R. W. MÜLLER. *Svensk Pappers-Tid.* 32, 530-2 (1928).—The app. is described.

WILHELM SÖGERBLOM

Longview mill evolves new technique for sulfate pulp process. R. S. WERTHEIMER. *Chem. Met. Eng.* 35, 596-600 (1928).—Description of the Longview Fibre Co. mill, Longview, Washington, with particular reference to the new type recovery system claimed to eliminate odors through burning of org. S compds. resulting from the process.

C. E. CURRAN

The sulfate process and kraft paper. GEORGE VOGHT. *Paper Mill* 52, No. 23, 26, 28, 58, 81; *Paper Trade J.* 88, No. 24, 77-8 (1929); *Paper Ind.* 11, 467, 469 (1929).—After a brief outline of the early development of the process, the latter is described.

A. PAPINEAU-COUTURE

Sulfur reactions in sulfate recovery systems. MARGOT DORENFELDT-HOLTAN AND E. HOLTAN. *Paper Trade J.* 89, No. 10, 59-60; *Papir-Journalen* 17, 70-3 (1929).—After a discussion of the reactions of S and S compds. in the recovery of sulfate black liquor, results are given of an investigation into the S balance of the recovery system, which are summarized as follows: of the S going to the recovery, 31.5% is lost in the

smelter, 24.75% is lost in the rotary and 17.25% is absorbed in the disks, making a net loss of 39%; 9.45% of the S sent to the recovery is present in the volatilized salts; 34% of the S added to the smelter is lost, 37% of the S added to the rotary is lost, and the disk evaporator absorbs 35% of the S added to it; the smelt contains 15.5% more S than the black liquor; the S from salt cake amounts to 50% of the S added to the system; the total S loss is 77% of the S added as salt cake. A. PAPINEAU-COUTURE

Modern recovery in sulfate and soda mills. C. L. WAGNER. *Paper Trade J.* 89, No. 14, 82-3(1929); *Pulp Paper Mag. Can.* 28, 598-9(1929); *Paper Ind.* 11, 1210-1(1929).—A brief outline of the latest improvements in the Wagner recovery furnace. It is claimed that total furnace recoveries of 97-8% are obtained, and that if use can be made of water at 160°F., the thermal efficiency of the unit is up to, or higher than, that of modern boiler units. A. PAPINEAU-COUTURE

The electro-natron process for the regeneration of sulfate black liquor. F. WALLENBERGER. *Papier-Fabr.* 27, 81-3(1929).—An exptl. plant is under construction to test this patented process, which is basically as follows: The black liquor is treated under suitable conditions with HCl, whereby the org. matter is pptd. and all the S driven off as H₂S, which is collected. The filtered liquor contg. NaCl is electrolyzed, giving H and Cl gases and NaOH soln. The 2 former are burned to give HCl, which is returned to the process, while the H₂S previously liberated is absorbed in the caustic soln. to form fresh cooking liquor. Losses, which should be small, are made up with NaCl and Na₂S. Special advantages are avoidance of odor and of lime sludge production. Sulfates in the liquor might prevent successful electrolysis. R. H. DOUGHTY

Volatile substances found in soda and sulfate cellulose plants, their use and means for rendering them harmless. E. ÖMAN. *Svensk Pappers-Tid.* 32, 313-7, 351-5(1929).—A résumé of the work of Bergström and Fagerlind on the useful volatile substances and of Klason, Brahmer and others on the useless volatile substances resulting in sulfate cellulose plants. WILHELM SEGERBLÖM

A new acid-resistant mortar for sulfite pulp digesters. HENRIK KREUGER. *Papier-Fabr.* 27, 348-9(1929).—See C. A. 23, 4341. R. H. DOUGHTY

Welded pulp digesters. T. McLEAN JASPER. *Paper Mill* 52, No. 26, 4, 6, 33(1929).—A general picture is presented of the development of welding in the various industries in which welded vessels have been in service continuously for about 4 yrs under the most severe working conditions. A. PAPINEAU-COUTURE

Safety precautions for preventing the explosion of digesters. ANON. *Svensk Pappers-Tid.* 32, 561-3(1929).—A recent explosion of a digester in a sulfite plant in Saxony is described. Precautions have been drawn up for the prevention of similar explosions. Detailed specifications are given for the inspection of digesters already in use as well as for those in process of construction. WILHELM SEGERBLÖM

Wood pulp of today. N. L. NORSSE. *Paper Ind.* 11, 471, 473(1929).—A brief outline of the development of high-purity wood pulps (contg. 92% and over of α -cellulose) and discussion of the reasons why they so readily find application in high-grade, coarse and fine papers. A. PAPINEAU-COUTURE

The evaluation of wood pulp. J. W. BERRIMAN. *Proc. Tech. Sec. Paper Makers' Assoc.* 9, 114-9(1929); cf. C. A. 22, 3294. C. E. CURRAN

Bibliography of wood pulp strength testing. W. F. MOORE. *Paper Trade J.* 89, No. 12, 62-72(1929).—A review in the form of abstracts of 63 articles published on the subject since 1915 (one reference in 1905). A. PAPINEAU-COUTURE

Observations on mechanical wood pulp. PER KLEM. *Papier-Fabr.* 27, 467-9(1929).—Mech. pulp (I) has been sepd. by screening into fibers (II) and fines (III) (Mehlstoß), and the characteristics of mixts. of these with each other and with unbeaten sulfite (IV) have been studied. Breaking length increased from 500 m. at 100% II to 3000 m. at 100% III, slowness from 12° to 80° Schopper. A max. breaking length was found in mixts. of 80% I and 20% IV, and of 60% III and 40% IV. Addn. of II to IV caused a steady decrease in strength. Hence, the fines are the more important part of mech. pulp from a strength standpoint. The "Hurum Mehlstoß Apparat" (or flour tester) for detg. the % of fines is recommended as a valuable testing instrument, both for mech. and chem. pulps, particularly in the relations of fiber characteristics to strength and slowness. R. H. DOUGHTY

Wood pulp and its properties. PER KLEM. *World's Paper Trade Rev.* 91, 2190-2200(1929); *Pulp Paper Mag. Can.* 28, 173-5(1929); cf. preceding abstr. A. PAPINEAU-COUTURE

The fiber length of wood pulps. G. K. BERGMAN and ALBERT BACKMAN. *Papier-Fabr.* 27, 449-56(1929).—The fibers of samples of unbeaten pulp were measured and counted on enlarged projections of carefully prepd. slides. The method of prepg. the

slides and of analyzing the data is given in detail; 1500 to 3000 fibers were used for each sample. The *av. fiber length* (I) (total length divided by no. of fibers) is disproportionately influenced by extremely short (0 to 0.5 mm.) fibers; the *equiv. mean length* (II) obtained from a distribution diagram is preferred for characterization of the pulp. Detailed measurements and diagrams are given for 13 samples. The ranges of values obtained for I and II, resp., are, in mm., for sulfite pulp, 0.755 to 0.896; 1.931 to 2.228; for sulfate pulp, 0.946 to 1.152; 2.043 to 2.380. Conclusions: Sulfate pulps contain less fibers of < 0.5 mm. than do sulfite pulps; the breaking of fibers in chipping is probably the main source of short pieces; the differences noted in fiber length between different pulps are unimportant from a paper-making standpoint, and the source of differences in pulp character usually charged to low fiber length should be sought for elsewhere.

R. H. DOUGHTY

Identification and evaluation of unbleached chemical wood pulps. GÖSTA A. HALL. *World's Paper Trade Rev.* 91, 1340-54, 1396, 1398, 1442, 1444, 1484-92, 1530-6, 1586, 1630-8, 1676-88, 1738-50, 1818-34, 1906-16; *Paper Maker & Brit. Paper Trade J.* 77, 479-87, 591-5; 78, 17-23; *Svensk Pappers-Tid.* 32, 356-60, 389-96, 423-8, 459-63 (1929); cf. *C. A.* 22, 3298; 23, 3078.—The relation between the treatment and properties of unbleached chem. wood pulps, particularly unbleached sulfite and sulfate pulps, is discussed in the light of H.'s investigations. With sulfite pulps the correspondence between the strength properties of the unbeaten pulps and the properties developed through beating is rather good, though not entirely reliable; but with unbleached sulfate pulps the results may be entirely misleading. This is attributed to the fact that the strength properties indicated by tests on unbeaten pulp depend largely on the felting capacity of the pulp, the fibers simply pulling apart without rupture in the tensile and bursting tests; while under similar conditions the fibers of any machine-made coarse paper break to a large extent, so that it is impossible to predict the character of the paper from tests on the unbeaten pulp. Tearing tests on the unbeaten and beaten pulps correspond remarkably well; so this test might be applicable to unbeaten pulps directly. The results obtained by beating in the Abbé pebble mill and in the Lampén ball mill are compared and discussed (cf. *C. A.* 23, 3087). A modification of the Sandberg and Bergman sheet-making machine has been devised. When the test sheets are made under conditions comparing with those of the paper machine, e. g., a sheet is assumed to be taken about the 1st wet press, the lab. paper is stronger (tensile, bursting and folding tests) because of the more uniform distribution of the fibers; if the pressure is lowered to about 200 lb. per sq. in., the character of the lab. paper compares rather well with that of the machine-made paper, showing that the influence of the decrease in pressure is then just about compensated by the better formation; at lower pressures the paper becomes too porous. Lab.-made paper pressed at about 200 lb. does not show higher tearing strength than machine-made paper, as could be expected, on account of the lower pressure, which fact indicates that tearing strength should be inversely proportional to the formation. The fine fiber fragments contained in the white water increase the tensile and bursting strengths and lower the tearing strength and porosity. Lampén mill beating gives a decidedly stronger (tensile and bursting strengths) and stiffer paper than paper mill beating to the same fineness. The pressure would have to be reduced to about 50 lb. in order to get a paper of the Lampén mill-beaten pulp with approx. the same strength properties as those of the machine-made paper; but the lab. paper thus prep'd. is considerably more porous than the machine-made paper. The factors of paramount importance to the character of chem. wood pulp are the character of the wood used, the degree of cooking and the treatment given the wood in the pulping process, each of which is briefly discussed. The results of a series of beating tests carried out on hard kraft, soft kraft, "strong" kraft, bleachable sulfate, direct-cooked sulfite and indirect-cooked sulfite led to the following conclusions, which indicate general trends only: (1) Sulfite pulps are generally more easily hydrated than sulfate pulps of corresponding bleachability, which is due to the lower α -cellulose and higher polysaccharide (β -cellulose) contents of the former. (2) A direct relation between lignin content on the one hand and folding, bursting and tensile strengths on the other hand must exist; the strength as indicated by these 3 properties increases with the lignin content. (3) The tearing strength shows a max. at a lignin content of about 5% in both the sulfate and sulfite series. (4) The sulfite pulps cooked with indirect steam show, relatively to the sulfate pulps of corresponding bleachability, higher bursting and tensile strengths but lower folding endurance and tearing strength. (5) The difference in strength between the direct-cooked and indirect-cooked sulfite pulps is probably due partly to the difference in β -cellulose content and partly to the fact that direct steaming is more harmful to the strength of the fiber

than indirect steaming. (6) The porosity is a more significant indication of the beating condition of the fiber than the "freeness" or "degree of beating"; from a practical viewpoint, however, the porosity cannot replace the freeness tests. (7) At the same degree of beating and the same lignin content, the sulfate pulps give more porous paper than corresponding papers made from sulfite pulps. (8) The harder the pulp, the more porous is the paper produced from it. (9) The less a sulfate pulp is cooked, the darker it is. (10) Sulfite pulps generally give a less absorbent paper than sulfate pulps; the absorbency stands in direct proportion to the degree of cooking for both kinds of paper. (11) There is a considerable difference in "self-sizing" through beating between sulfite and sulfate papers, which is attributed to the rosin and β -cellulose, the latter, upon beating, gradually disintegrating and filling the interstices between the fibers, making the paper less absorbent. The discussion by those present at the presentation of the paper is given.

A. PAPINEAU-COUTURE

Pulping of wood with magnesium bisulfite solutions. BRUNO POSSANNER VON EHRENTHAL. *Papier-Fabr.* 27, 537-43(1929).—Five cooks were made in a 50-l. digester, using liquors contg. 0, 25, 50, 75 and 100% Mg, resp., and the remainder Ca bisulfite, with about 5.1% total and 1.2% combined SO_2 . Chips and liquor were placed in the digester overnight for thorough penetration. At the start of the cook the temp. was brought to 105° in about 20 min., shut in for 3 hrs., then brought to 128°, which was maintained until titration of a liquor sample showed but 0.1-0.2% SO_2 , when the cook was considered completed. The more important results are given for the different cooks in increasing order of Mg content as above: total time, 10.5, 9, 8.2, 7.5, 8.5 hrs.; yield, 42.2, 40.8, 40.6, 41.3, 45.5%; Cu no., 3.7, 3.1, 2.8, 2.6, 2.5; Sieber Cl₂ no., 42, 40, 38, 25, 23; α -cellulose, 67, 79, 73, 76, 76%; lignin, 4.4, 4.1, 3.7, 3.2, 2.8%. These results are strongly favorable to the use of Mg base for sulfite pulping. Considerable space is given to discussion of the practicability of using waste potash-works waters, contg. about 50% MgCl_2 , as the source of Mg. The liquor used in the present case, prepd. by pptg. MgCl_2 with Ca(OH)_2 and using the Mg(OH)_2 sludge, contained considerable CaCl_2 . One advantage of using pptd. Mg(OH)_2 is its rapid absorption of SO_2 , due to large and fresh surface.

R. H. DOUGHTY

Pulping of red beech and white birch by the sulfite process. OTTO WURZ. *Papier-Fabr.* 27, 495-8(1929).—Heuser (cf. Hügglund, C. A. 23, 4067) has claimed that deciduous woods cannot be pulped successfully by the sulfite process, at least without using a very high CaO liquor. Sembritzski reports favorable results, while Klein (C. A. 23, 5585) states that "beech and birch have been pulped by secret sulfite processes for some time" in Germany. W. suspects that difficulties in pulping beech wood may be due to the high density requiring a longer penetration period than for spruce. Chips of both woods were first pulped by suspending in a large digester during a regular cook on spruce, and later in an exptl. digester of 7 l. capacity, in which the ratio of wood to liquor was 1 to 7. Yields of 49% of readily bleachable pulp with an α -cellulose content of 87-88% were finally obtained from both woods. The beech was pulped with an acid contg. 5.05% total, 1.3% combined SO_2 , taking the temp. to 110° in 3 hrs. and to 140° in 6 hrs. more. The acid used on the birch contained 4.6% total, 1.3% combined SO_2 and a max. temp. of 132° was reached in 4 hrs. from 110°. Careful control near the end of the cook was necessary to prevent burning. The waste liquor was much darker than that from spruce, and a good washing of the pulp was required for even and complete bleaching. The possibilities for use of this type of pulp, which appear promising, should be studied in large-scale operations.

R. H. D.

Decay in pulp wood. G. AUDREY RICHARDS. *Paper Mill* 52, No. 41, 14, 33-4 (1929).—A brief discussion of the causes and mechanism of the rotting of pulp wood, and of the proper manner of storing pulp wood to prevent decay.

A. P.-C.

Groundwood pulp. JOSEPH H. SLATER. *Paper Mill* 52, No. 41, 13, 35(1929).—A brief discussion of some of the more recent developments in groundwood manuf. (control by means of the freeness test, use of Norton artificial pulp stones).

A. P.-C.

Scientific control in a groundwood mill. WILLIAM H. BRYDGES. *Paper Mill* 52, No. 23, 36, 53-4; *Paper Trade J.* 88, No. 25, 70(1929); *Paper Ind.* 11, 654-5; *Pulp Paper Mag. Can.* 28, 257-8(1929).—A brief discussion of the advantages of scientific control in maintaining uniform quality of pulp to meet the requirements for which it is intended, together with a brief description of the merits of the Meyer grinder governor.

A. PAPINEAU-COUTURE

The shive count as a factor in mill control. A. B. LARCHER. *Paper Mill* 52, No. 23, 42; *Paper Trade J.* 88, No. 24, 93(1929).—A brief discussion of the application of shive count for controlling the quality and uniformity of soda pulp.

A. P.-C.

Parenchyma in straw pulp. KORN. *Papier-Fabr.* 27, 311-4; *Wochbl. Papier-*

fabr. 60, 614-7(1929).—By *parenchyma* is meant bundles of cells in their natural state; single cells are not considered. It was found by microscopic testing that the majority of flecks in very badly flecked papers were these parenchyma bundles. No direct relation appeared between method or degree of pulping, and freedom from these flecks; accurate knowledge of the whole process of prepreg. the pulp is required for detg. this. Since parenchyma occurs mainly in the nodes, careful removal of these before (or) after pulping is necessary. Four photomicrographs of typical flecks are given.

R. H. DOUGHTY

Pulping straw with nitric acid. H. SUIDA, H. SADLER AND F. NOSS. *Papier-Fabr.* 27, *Fest- u. Auslands-Heft*, 71-9(1929); cf. *C. A.* 22, 4807.—In this study 50 tests were made, using 30 g. straw, 230 cc. HNO_3 of 1.4 to 10.8% by wt. concn., reaction times of 35 to 80 min., and temps. of 68-99° (temp. of bath; av. temp. of reacting material 10° lower). The material was pulped in covered beakers in a H_2O bath, the acid lost by evapn. being detd. The pulp was washed with hot H_2O , treated 30 min. with 300 cc. hot 1.7% NaOH soln., washed with HOAc and H_2O , and dried to det. the yield. In a second series of 30 tests the concn. and temp. of the NaOH soln. were varied, and in a third series of 25 tests the pulping time was increased to 180 min. Detailed data covering the yields are presented, and it is stated that all pulps lower than 50% yield appeared, from bleachability tests, technically usable. The yields varied from 40% with a useful HNO_3 consumption of 50% (basis pulp) to 45-50% with 15% of HNO_3 , and 60% with 5% of HNO_3 . The yields from the various tests varied in the usual manner with acid consumption, with time, temp. and concn. of the acid, and with temp. and concn. of the alkali wash.

R. H. DOUGHTY

Burma bamboo pulp. WM. RAITT. *World's Paper Trade Rev.* 92, 724-8, 812-20 (1929); cf. *C. A.* 23, 3091.—A report on an extensive survey of the possibilities of bamboo as a source of paper pulp, dealing with available supplies, quality of the product and cost of production.

A. PAPINEAU-COUTURE

Pulping flax straw. VI. Properties of flax straw cellulose and its value in the cellulose industries. EARL R. SCHAFER AND MARK W. BRAY. *Ind. Eng. Chem.* 21, 278-80; *Paper Trade J.* 89, No. 5, 51-3(1929); cf. *C. A.* 22, 4808.—A description of the compn. of flax straw and of the pulps obtained therefrom by the lime, NaOH , Cl and sulfate processes.

A. PAPINEAU-COUTURE

Variation of the density of sulfate black liquor with changes of temperature. HARRY D. CRANDON. *Paper Trade J.* 89, No. 6, 59-61(1929).—The variation in d. of sulfate black liquor as compared with water at 20° was detd. over a temp. range of 25-95°, and it was found that no matter what the initial d. of the black liquor may be (within the range of mill practice) the change of d. over the temp. is uniformly the same.

A. PAPINEAU-COUTURE

Reaction products of alkaline cooking process. H. E. WAHLBERG. *Pulp Paper Mag. Can.* 27, 797-800, 828(1929).—See *C. A.* 23, 3090. A. PAPINEAU-COUTURE

Tentative method for the analysis of salt cake. F. J. CURTIS. *Paper Trade J.* 88, No. 22, 41(1929).—A description of the method tentatively proposed for adoption as official by the Technical Assoc. of the Pulp and Paper Industry.

A. P.-C.

Analysis of hypochlorite bleaching materials. W. L. SAVELL. *Paper Trade J.* 88, No. 21, 81-2(1929); *Paper Mill* 52, No. 32, 24-5(1929).—A description of the methods to be used in the analysis of bleaching powder or of bleach liquor, including sampling, available Cl (arsenite method, Bunsen method, Mathieson bleach tester method), chlorates, CaCO_3 and alkyl.

A. PAPINEAU-COUTURE

New method for determining copper number. K. G. JONAS AND A. DRÖSSEL. *Paper Trade J.* 89, No. 9, 49-50; *Papier-Fabr.* 27, *Fest- u. Auslands-Heft*, 109-12(1929); cf. *C. A.* 22, 4800.—The following modification of the Schwalbe-Braidy method for detg. the Cu no. of pulp is proposed: Soften 2.5 g. of pulp with 50 cc. of water in a 300-cc. flask (with highly pressed pulps it is best to allow the mixt. to stand overnight), shake by hand for 2 min. with 25 glass beads 7 mm. in diam., transfer to a 300-cc. Erlenmeyer flask with 50 cc. of water, heat to 100°, add the boiling Braidy soln. (10 cc. of CuSO_4 and 190 cc. of carbonate-bicarbonate soln.) and complete the detn. by the usual Schwalbe-Braidy method.

A. PAPINEAU-COUTURE

The copper number determination. E. RICHTER. *Wochbl. Papierfabr.* 60, 261-4 (1929).—As a rough control method the Schwalbe detn. may be carried out by heating to 91° for 1 hr. in a water bath without a stirrer. The results are high but fairly regular. By using the Schwalbe-Braidy method, the Cu no. of machine-dried or of beaten pulp was found to be higher than that of the wet or unbeaten stock. The Ag no. (*C. A.* 23, 971) requires too much time to be of use as a routine detn.

R. H. DOUGHTY

Scientific research in connection with the manufacture of pulp and paper. HAROLD

HIBBERT. *Pulp Paper Mag. Can.* 28, 5-8(1929).—An outline of the fundamental chem. research carried out at McGill Univ., during the past 3 yrs., relating to the pulp and paper industry. A. PAPINEAU-COUTURE

Practical research at the Pulp and Paper Research Institute, Montreal. E. P. CAMERON. *Pulp Paper Mag. Can.* 28, 11-6, 40, 42(1929).—A discussion of considerations in the design and operation of the semi-com. exptl. pulp and paper mill and lab. of the Pulp and Paper Research Institute, Montreal. A. PAPINEAU-COUTURE

Recent activities of the paper research laboratory of the Bureau of Standards. B. W. SCRIBNER. *Paper Trade J.* 88, No. 25, 65-9(1928); cf. *C. A.* 22, 1681.—A detailed résumé of the research accomplishments for 1928 is given. A. P.-C.

Paper research literature. I. Revised. C. J. WEST. *Paper Trade J.* 89, No. 1, 56-62(1929); cf. *C. A.* 22, 3296.—A list of contributions by members of the Forest Products Lab., Madison, Wis., on pulp and paper, from 1910 to 1928. A. P.-C.

Activities of the research committee of the Svenska Pappers-och Cellulosa-Ingénjörss-Föreningen. BERTHOLD SMAERT. *Papier-Fabr.* 27, 393-4(1929).—Fifteen problems are under consideration, of which 9 are listed, with brief comments. R. H. DOUGHTY

Inspection of paper. L. P. PARKMAN. *Paper Mill* 52, No. 41, 10, 40(1929).—A discussion of the importance of interdepartmental inspection of paper in order to obtain proper and uniform quality of the finished product, together with a description of the system in use at the mills of the S. D. Warren Co. A. PAPINEAU-COUTURE

Notes on analytical paper microscopy. K. P. GEOHEGAN. *Paper Mill* 52, No. 22, 18-9, 22-4; *Paper Trade J.* 88, No. 23, 63-5; *Paper Ind.* 11, 473-9; *Pulp Paper Mag. Can.* 28, 363-6, 382(1929).—A brief discussion of the various applications of the microscope to paper analysis, with bibliography of 25 references. A. P.-C.

Report on the microscopical analysis (of paper). C. E. LIBBY. *Paper Trade J.* 88, No. 22, 44-5(1929).—A final compilation of the results of collaborative work carried on during the past 2 yrs. to det. the accuracy of the dot-count method of fiber analysis. As the groundwood content found was consistently low and the deciduous wood soda pulp consistently high, it is suggested that the establishment of wt. factors for these 2 fibers would increase the accuracy of the method. Though the av. error was higher than that by the present standard methods of analysis, the dot-count method is likely to give better results than the present standard methods in the hands of an analyst relatively inexperienced in fiber detns., and its adoption as official by the Technical Assoc. of the Pulp and Paper Industry is therefore recommended. A. P.-C.

The function of chemical analysis in the manufacture of papier mâché. A. LAMBRETTE. *Papeterie* 51, 737 8, 798(1929).—A brief description of a scheme of analysis of papier mâché and discussion of the interpretation of the results. A. P.-C.

United States patents on paper making. CLARENCE J. WEST. *Paper Trade J.* 89, No. 5, 54-6(1929); cf. *C. A.* 23, 4067.—A list of U. S. patents on paper making issued during April, May and June, 1929. A. PAPINEAU-COUTURE

Tests on papers. KORN. *Papier-Fabr.* 27, 362-3; *Wochbl. Papierfabr.* 60, 710(1928).—A comparison of tests made during the current and preceding years shows an increase in no. of about 60%; decrease in rejections from 38 to 25% of samples tested; increase in av. breaking length of 2% folding strength of 50% for all samples tested. The presence of watermarks lowered the tensile and folding strengths 10 and 20%, resp., when samples cut in the watermark were compared with other portions of the sheet. R. H. DOUGHTY

The value of tests for paper. H. Z. SCHNIEWIND. *Pulp Paper Mag. Can.* 28, 289-91(1929).—A brief discussion of the value of testing paper to det. its suitability for the purpose for which it is intended. A. PAPINEAU-COUTURE

Practical paper tests for printers. GEORGE FRENCH. *World's Paper Trade Rev.* 92, 50-4(1929).—A brief outline of simple tests which should be made by the printer to det. the fitness of paper for any sp. use. A. PAPINEAU-COUTURE

The printer's paper problems. R. I. DRAKE. *Paper Trade J.* 88, No. 24, 95 7, *Paper Mill* 52, No. 24, 20-3; *Pulp Paper Mag. Can.* 27, 9:9-61; *Paper Ind.* 11, 651 3(1929).—A discussion of the troubles due to poor splices, rolls with soft ends, formation, finish, opacity, sizing, loading and shipping. A. PAPINEAU-COUTURE

Evolution of the composition of printing papers in Italy since the introduction of wood pulps. L. VIDAL. *Papier* 32, 507 12(1929).—A description of the compn. of a large no. of samples of Italian papers, manufd. from about 1830 to the present time, from analyses made by V. A. PAPINEAU-COUTURE

Newsprint manufacture in Canada. G. SUNDT. *Papir-Journalen* 17, 29-32(1929).—Description and comments on the widespread use in the Canadian newsprint industry of wide, high-speed machines, pressure slices, consistence control, suction

couches, elec. section drives, machine room ventilation, recirculation of white water, and fiber recovery. The total fiber loss in a modern mill is seldom more than 0.75% of the paper production. C. E. PETERSON

The two-sidedness of printing papers. E. H. RIESENFELD AND T. HAMBURGER. *Papier-Fabr.* 27, 528-9(1929).—The ash content of 14 papers was detd. on the wire and top sides. In 12 cases the ash content of the top side was higher, which is contrary to general opinion. In 7 cases, the ash content of the whole sheet was greater than that of either side. R. H. DOUGHTY

Fine papers. I. M. YOERG. *Paper Mill* 52, No. 24, 2, 6(1929).—A no. of points of interest in the manuf. of fine papers are raised, with a suggestion that they be discussed in the best interests of the fine paper industry at large. A. PAPINEAU-COUTURE

The manufacture of carbon papers. J. ODDON. *Papier* 32, 875-80(1929).—Practical directions regarding the manuf. of the base paper and of its coating with the coloring emulsion. A. PAPINEAU-COUTURE

High-grade filter paper. W. SCHMID. *Papier-Fabr.* 27, 187-90(1929).—Details of manuf. are described. R. H. DOUGHTY

Mulch paper. CHARLES W. RIVISE. *Paper Trade J.* 89, No. 2, 55-7(1929).—A review of patents taken out in the U. S. on paper mulching. A. PAPINEAU-COUTURE

Critical study of methods of measuring the bulk of paper. F. T. CARSON. *Paper Trade J.* 89, No. 15, 55-61(1929).—See C. A. 23, 4341. A. PAPINEAU-COUTURE

Is it possible to determine the mechanical pulp content of paper accurately to fractions of a per cent? KORN. *Wochbl. Papierfabr.* 60, 236-7; *Papier Ztg.* 30, 472; *Papier-Fabr.* 27, 142(1929); cf. C. A. 22, 4806.—The method in question (cf. Halse, C. A. 19, 1946) bases an est. of the amt. of mech. pulp on the lignin detn., using empirical values for the lignin content of av. mech. and chem. pulps. The probable inaccuracy of such a test is obvious. Some remarks on the accurate determination of mechanical pulp in paper. FRANZ FRANK and FRANZ MÜLLER. *Wochbl. Papierfabr.* 60, 484-5(1929).—The Halse method has an error of the order of $\pm 10\%$. R. H. DOUGHTY

Chemical determination of groundwood in paper. E. H. RIESENFELD AND T. HAMBURGER. *Cellulosechemie* 10, 125-6(1929).—The Halse chem. method of detg. the groundwood or mech. pulp content of paper (cf. C. A. 19, 1946; 22, 4806) can give accurate results only when the lignin content of the component pulps is accurately known. Analyses of 4 paper samples of known groundwood content gave less satisfactory results than would be obtained by the microscopic method. OSCAR T. QUIMBY

Tendencies and aims of fibrous material analysis. C. G. SCHWALBE. *Papier-Fabr.* 27, 293-5(1929).—An address, outlining the methods and aims of research on pulp and paper, and especially the work of the Faser-Analysen Commission. R. H. DOUGHTY

Purified wood fibers as a paper-making material. ROYAL H. RASCH. *Bur. Standards J. Research* 3, 469-506(1929); cf. C. A. 23, 3096. F. A. SIMMONDS

Suitability of eucalyptus for paper pulp. BENNETT PREBLE. *Paper Trade J.* 88, No. 26, 53-60(1929).—After reviewing the work which has been done to date on the pulping of eucalyptus, an account is given of an investigation into the pulping characteristics of the principal species of eucalyptus grown in California (*E. globulus* (blue gum), *E. torynocalyx* (sugar gum), and *E. tereticornis* (gray gum)). The sulfate process was used at first, but as its use had to be discontinued, the so-called "hypo" process (using a soln. of NaOH and of $\text{Na}_2\text{S}_2\text{O}_4$) was used, which, though it probably could never be used commercially, gives a pulp very similar to sulfate pulp. Blue gum was very easily reduced, giving a high yield of light-colored pulp. Although the fibers are shorter than those of red cedar (taken as typical of the conifers), the felting power (ratio of length to diam. of fibers) is high. The strength developed by a remarkably short heating period is higher than that of the best sulfite pulp. Slightly less favorable results were obtained with gray gum, the pulp being much darker than that of blue gum and somewhat darker than that of red cedar, and not quite as strong as that from blue gum. Sugar gum did not give promising results, the wood being hard to reduce and the color of the pulp poor. Further efforts on pulping of this species by alk. processes are not considered worth while, and it is suggested that the possibility of pulping it by the sulfite process be investigated. A chronological bibliography of work on the use of eucalyptus for paper making is given. A. PAPINEAU-COUTURE

New processes for the production of paper pulp from wood. ARTHUR ST. KLEIN. *Papier-Fabr.* 27, 325-30(1929).—A literature and patent review of suggested new processes and modifications to old processes of pulping. In spite of the great no. of such suggestions, an entirely new. practical and inexpensive pulping process has not yet

been proposed, and the fundamental factors governing the paper-making qualities of a pulp have yet to be explained.

R. H. DOUGHTY

Paper-making value of papyrus from Northern Rhodesia. ANON. *World's Paper Trade Rev.* 92, 1-2(1929); *Paper Maker & Brit. Paper Trade J.* 78, 169-70(1929).—The compn. of the material was: H₂O 8.1, ash 4.1, cellulose 37.7% (on dry basis 41.0), fiber length 0.8-4.0 mm (av. 1.72), fiber diam. 0.005-0.0254 mm. (av. 0.0126). Cooked with 16% NaOH (on the wt. of the stems) at a concn. of 3% for 3 hrs. at 140°, it yielded 35% of well-reduced unbleached pulp which furnished a thin translucent type of hard, rather rattly, pale brown paper of excellent strength, contg. a small quantity of imperfectly digested material. The pulp bleached fairly readily (yield 27% on the original material) to a pale cream color, and then furnished paper similar in strength and character to that from the unbleached pulp, except that it contained practically no imperfectly digested material. After removing about 30% of pithy material by mech. means, the compn. was: H₂O 6.7, ash 4.2, cellulose 40.0% (42.9 on dry basis). Under the same cooking conditions as above it yielded 40% unbleached and 34% bleached pulp, which furnished a rather hard, rattly, opaque paper, somewhat superior in quality to that from the original stems. Sepg. 28.5% pith mechanically, soaking in H₂O, boiling in H₂O, boiling 30 min. with 1% NaOH, washing free from NaOH, beating lightly and finally washing, sieving and drying yielded 17.9% of fibers with only a slight quantity of pith adhering. The quantity obtained was too small to permit of making sheets.

A. PAPINEAU-COUTURE

Paper-making value of reeds from Northern Rhodesia. ANON. *World's Paper Trade Rev.* 92, 185-6(1929). Reeds (*Phragmites vulgaris*) had the following compn. H₂O 7.5, ash 1.9, cellulose 50.0 (on dry basis 54.1%), fiber length 3.0-6.8 mm. (av. 1.7), fiber diam. 0.0102-0.0580 mm. (av. 0.0193). Cooking with 16% NaOH (on the wt. of the stems) at a concn. of 4% for 4 hrs. at 140° gave 49% of generally well-reduced pulp, which furnished a rather soft, opaque, fairly bulky, pale yellowish brown paper of fairly good strength, but contg. numerous specks of imperfectly digested material from the nodes. The pulp did not bleach readily, but after treatment with a strong bleaching soln. it yielded 39% (on the original material) of cream-colored pulp, which furnished a paper of similar character and strength to that from the unbleached pulp. Cooking as above, but at 150°, gave 47% of unbleached and 39% of bleached pulp of satisfactory whiteness, which gave a paper free from unbleached specks. The pulp is rather similar to that furnished by esparto, but requires about twice as much bleach. In practice, the nodes could readily be removed in screening the pulp. A. P. C.

Paper pulp from New Zealand-grown woods. A. R. ENTRICAN. *New Zealand J. Sci. Tech.* 11, 65-80.—Insignis pine and kahikatea groundwood pulps were yellowish but strong, the sulfite pulp had a good color, and the sulfate pulp was good. Rimu and kauri were generally suitable. Austrian and Corsican pines and European larch produced fairly strong wrapping papers. Of the hardwoods, tawa was best for a variety of pulps; the unbleached sulfite was suitable for a new type of newsprint. The remaining hardwoods were limited to bleached soda pulps for book and similar paper.

F. A. SIMMONDS

Megass. Its value as a material for the manufacture of paper and of artificial silk. ANON. *Trop. Agr.* (Trinidad) 6, 200-2(1929).—Megass, as received, contained 10.8% H₂O, 1.2% ash and 51.2% cellulose. A course of treatment was devised which converts this material into a form suitable as a source of cellulose for the paper and artificial silk industries, but it is not believed to be cheap enough for present exploitation.

A. L. MEHRING

The effect of atmospheric humidity on paper. L. E. WALTER. *Papier-Fabr.* 27, 369-71(1929).—The rate of change of weight and length with varying humidity of strips of 13 papers from 3 mills was detd. at 10° and 740-mm. barometric pressure. The samples were cut from the center of the web and stored 6-8 weeks in a cold dry room before testing. It was found that: (1) Moisture was absorbed or given up more rapidly from strips cut in (I) rather than across (II) the machine direction; (2) at low humidities the max. moisture content of the paper increased more slowly, in the middle range at the same rate, and at high humidities faster than the moisture content of the air; (3) the elongation in II (too small to be detd. in I) was proportional to the water taken up, and hence bore the same relation to relative humidity; (4) the absorption and giving up of H₂O at ordinary temp. is entirely reversible; (5) the elongation is partially irreversible.

R. H. DOUGHTY

Hydration, paper formation and strength. GUNNAR PORRVIK. *Pulp Paper Mag. Can.* 28, 133-6, 149-50; *Svensk Pappers-Tid.* 32, 191-6(1929).—The degree of freeness of pulp is detd. by the water which the pulp holds, which is of 3 kinds: outer capillary

water (remaining in the interstices between the fibers), inner capillary water (in the lumen of the fibers) and water in the fiber walls. The holding together of the fibers in paper is not in any essential degree a felting process, but a phenomenon of colloidal chem. "sizing," or binding of the fibers to one another. The significance of beating is that, through mech. working, the degree of swelling of the fiber walls is increased, whereby the fibrous tissues are rendered more capable of "sizing" and more plastic. The fibrous walls consist of several sheaths; when the outer sheath (the "sizing" sheath) swells, the power of the "sizing" particles is increased, and thereby the strength. When the fundamental substance swells, the fibers are split into fibrils, and a paper of more delicate texture is obtained. Beating is not an uninterrupted process, but falls into 3 stages, during which essentially different phenomena occur. In the 1st stage, extending to 30° Schopper-Riegler, the inner capillaries are filled and a portion of the sub-microscopic "sizing" substance in the fiber walls is filled with water with simultaneous expulsion of air. In addn., a colloidal swelling of the fiber walls takes place. This results in an increase in the vol. of the fibers in their moist state and produces a great increase in their plasticity and "sizing" power. In consequence, these fibers are much more capable of union and sticking together after pressing. In this stage the outer capillaries contract, contributing to the making of a thicker paper with lower absorbency. The most important effect is the fact that the surfaces of the fibers that touch one another increase. In the 2nd stage, extending from 30° to about 80° Schopper-Riegler, the swelling caused by kneading of the fibers increases, which especially contributes to the plasticity of the fibers and the "sizing" power of the outer layer. In the 3rd stage, above 80° Schopper-Riegler, there is an active splitting into fibrils, whereby the inner capillaries cease to exist. Between the fibers a new capillary surface is formed, very short, and consequently resistant to pressure.

A. P.-C.

Effect of drying on the strength of paper. ERNST RIETH. *Papier-Fabr* 27, 385-7 (1929).—Sample sheets of a beaten pulp dried freely in the air gave a tensile test of 5800 m. breaking length and 2400 double folds, while others dried at 103° on a cylinder under tension tested 8300 m. and 1100 folds. The shrinkage on drying and H₂O content after seasoning at 65% relative humidity were lower in the latter case. Other methods gave intermediate values. Drying on the cylinder to various moisture contents showed that the more the paper was dried, the less its equil. moisture content, and that drying to below 8% moisture was necessary to give max. tensile strength. It is pointed out that the degree of hydration is an important factor in strength testing, that this may vary even with the same pulp beaten to the same slowness in different ways, and that control of drying procedure offers a way of controlling the effect of this variable in testing.

R. H. DOUGHTY

p_H control in the paper mill. A. B. HANSEN. *Paper Mill* 52, No. 40, 3, 6 (1929) — A definite ratio between size and alum should not be followed for different papers. The best p_H value for sizing may not be the same for different mills. It should be detd. for each mill. It will probably lie between 4.0 and 6.5. Decreasing the p_H value or increasing the H-ion concn. increases the rate of deterioration of paper. In general, beating takes place more rapidly at higher p_H values than at lower ones. Decreasing p_H values increase the corrosiveness of stock and white water on paper-mill equipment. A "standard" p_H value for each grade of paper should be set at each mill and followed closely.

A. PAPINEAU-COUTURE

Hydrogen-ion control in paper plants. R. KARLBERG. *Svensk Pappers-Tid.* 32, 308-13 (1929). H-ion control in paper plants is not a new idea as evidenced by the early use of litmus paper in detg. the acidity of the pulp. Methods of detg. p_H and app. used therein are described. The applicability of p_H detns. in the pulp and paper industry is discussed. K. suggests a more detailed study on the relation of p_H to the resin content.

WILHELM SEGERBLOM

Hydrogen-ion control and pitch troubles in the paper mill. ROBERT KARLBERG. *Papier-Fabr.* 27, 358-62 (1929).—The paper machine stock in a mill experiencing serious pitch trouble varied between p_H 6.6 and 3.6 without apparent cause. Continuous control was established and it was found that holding the p_H between 4.4 and 5.0 by means of alum eliminated all trouble, even when a hard sulfite was used. When half of the alum was replaced by H₂SO₄ for a 5-day period, pitch appeared on the doctors and press rolls. This behavior is in agreement with the sizing theory of Roschier (C. A. 22, 3299). It is doubtful if the same limits would apply in all mills and under all conditions, thus, in this mill during the winter months the p_H could be allowed to run as high as 6 for several days without trouble. K. believes, however, that a careful study would improve conditions in any mill.

R. H. DOUGHTY

Economical use of water (in the paper industry). C. A. BLODGETT AND W. D.

SOMERVILLE. *Paper Mill* 52, No. 41, 15, 36(1929).—A discussion of the advantages derived from white recirculation and utilization. A. PAPINEAU-COUTURE

Domestic clays for filling and coating paper. OLIN W. CALLIGHAN. *Paper Trade J.* 89, No. 14, 74-9(1929); *Paper Mill* 52, No. 39, 12-3, 38, 40, 44; No. 40, 24-5, 40(1929).—A discussion of the merits of domestic (U. S.) clays over foreign (English) clays for filling and coating paper, with a description of their properties and methods of testing. A. PAPINEAU-COUTURE

China clay in relation to paper. J. EDINGTON AITKEN. *World's Paper Trade Rev.* 91, 2082-92(1929).—An address reviewing the function of china clay in paper, its prepn. and valuation. A. PAPINEAU-COUTURE

Detection of starch, glue and casein in and upon paper. T. C. BENTZEN. *Paper Mill* 52, No. 21, 20-1(1929); *Paper Trade J.* 88, No. 23, 59(1929).—Detailed directions are given for the detection of starch as surface sizing or loading by means of I soln. Glue and casein can be detected by the NH_4 molybdate ppt. Glue is tested for by means of 10% tannin soln., and casein, if present, will give a ppt. with NH_4 molybdate in the filtrate from the tannin-glue ppt. A. PAPINEAU-COUTURE

Determination of particle size of fillers for paper. HERSTAD. *Papir-Journalen* 16, 241-4(1928).—The most satisfactory results are obtained when the filler is kaolin of 20 μ to 30 μ . Of the many types of equipment for measuring particle size the best for this purpose is a sedimentation apparatus designed according to Wiegner-Gessner and equipped with automatic photographic equipment. A complete detn. can be made in one day covering fractions from 100 μ to 2 μ . C. E. PETERSON

Freeness. H. E. JORGENSEN. *Papir-Journalen* 16, 239-41(1928).—Freeness detns. as measured by instruments having different mesh screens are in a logarithmic relation to each other, and readings from one instrument may be converted to another by a straight-line graph on log paper. A graph is also presented to coordinate readings taken on an American freeness tester, with 3 or 4 g. pulp per l. and with a German "Mahlungsgrad" tester using 2 g. per l. C. E. PETERSON

Rosin-wax size. G. H. LAFONTAINE. *Pulp Paper Mag. Can.* 27, 970(1929).—A brief discussion of the advantages of rosin-wax mixts. over straight rosin for engine sizing. A rosin-wax emulsion suitable for sizing has been successfully prepd. and used for the last 4 yrs. A. PAPINEAU-COUTURE

Rosin sizing. ALMERON W. WICKHAM. *Paper Trade J.* 88, No. 24, 93, 94; *Paper Mill* 52, No. 24, 16; *Pulp Paper Mag. Can.* 27, 919-20; *Paper Ind.* 11, 657-8(1929). A brief address emphasizing the necessity for proper control of rosin sizing. A. P.-C.

Rosin sizing in paper making. C. E. MUELLER. *Paper Mill* 52, No. 23, 18, 20, 60, 62, 81; *Paper Trade J.* 88, No. 24, 79-82; *Pulp Paper Mag. Can.* 28, 219-20, 238-42(1929).—After a brief discussion of the effect of the p_H value of the stock, showing that the optimum p_H value varies according to mill conditions and the qualities required of the finished paper, a no. of examples are given of sizing troubles actually encountered in paper mill practice and of the ways in which they were eliminated. A. P.-C.

Paper sizing patent review. JOSEPH ROSSMAN. *Paper Trade J.* 89, No. 4, 54-60(1929).—A review of U. S. patents for engine sizing, with abstracts of patents from 1852 to July 31, 1928. A. PAPINEAU-COUTURE

The influence of size and alum on the coloring of paper in the beater with aniline dyestuffs. P. W. CARR. *Paper Maker & Brit. Paper Trade J. International No.*, 61-2(1929).—A very brief discussion of the effects of size and alum on the coloring of paper in the beater by means of basic, acid and direct dyes. A. PAPINEAU-COUTURE

The Delthirna rosin sizing process. E. HOCHBERGER. *Papier-Fabr.* 27, 83-91, 97-9(1929).—The novelty of the Delthirna process (I) (cf. Delacroix, C. A. 22, 4811) is mainly in the app. by means of which the rosin is brought into soln. with NaOH in the cold. The process is compared with the usual method of sizing (II) as regards economy and the properties of the sized papers as detd. by ink and NaOH size tests and p_H of the H_2O ext. Of 66 samples of Delthirna-sized paper, 22 were better, 5 equally well and 39 worse sized than comparable sheets sized in the usual way. Sheets of less than 50 g./sq. m. were poorly sized. The p_H of H_2O ext. from papers sized by I range from 4.5 to 5.8, that of papers sized by II from 5.5 to 5.8, indicating nonuniformity of sizing in I. If the alkali used in I is partially replaced by carbonate, the rosin content of the size decreases rapidly with increase in carbonate. The effect of diln. on p_H is also altered. Conditions governing pptn. and flocculation of the rosin were studied. It was found that in II the p_H of the liquid is lower, the $\text{Al}(\text{OH})_3$ higher, and the excess SO_2 considerably higher than in I. These and other effects are discussed in detail in the light of various theories of sizing. R. H. DOUGHTY

Fundamental principles of the Delthirna process. GERALD STRECKER. *Papier-*

Fabr. 27, 99-102(1929).—The novelty, efficiency and economy of the process (cf. preceding abstract) are defended. E. HOCHBERGER. *Ibid* 102-3.—Reply. R. H. D.

Bakelite sizing by the beater method. JOSEPH ROSSMAN. *Paper Trade J.* 89, No. 2, 61-2(1929).—A description of Bakeland's U. S. pat. 1,160,362, March 16, 1915, Redman and Cheetham's U. S. pat. 1,551,428 (C. A. 20, 267), and Haanen's U. S. pat. 1,630,424 (C. A. 21, 2385).

The gloss of paper: an exact method of determination. L. BLIN DESBLEDS. *Paper Maker & Brit. Paper Trade J.* 78, 151-5(1929); *International No.*, 36-9(1929).—A description of the T. C. B. photocolormeter, with a discussion of its merits as a means of measuring the gloss of paper. A. PAPINEAU-COUTURE

Determining the action of the Elmendorf (tearing test) apparatus. HANS NAGL. *Papier-Fabr.* 27, 421-4(1929).—The tear test is especially valuable in showing the extent to which the fibers have been shortened in processing. The same pulp beaten to 60° Schopper slowness in beaters with stone and with iron tackle gave, resp., 190 and 111 g. tear. In general, tensile strength and tear vary inversely. Calendering decreases the tear, while normal moisture variations are without definite effects. Basis weight and no. and width of strips torn affect the test. R. H. DOUGHTY

Beating. P. E. HODGSON. *Paper Ind.* 11, 479-83; *Paper Trade J.* 89, No. 3, 61-3; *Paper Mill* 52, No. 28, 20-4(1929).—It has been found in practice that rebuilt high speed beaters have the following advantages over the Hollander type beater; increased circulation, ensuring good mixing and uniformity of sizing and coloring; saving in power; greater production due to the combined effects of faster circulation; greater size of tub and higher stock consistency; quicker and easier dumping and higher roll speed. Exceptionally promising results have been obtained with a new type of vertical beater, built by Love Bros., Aurora, Ill., consisting of 10 vertically superposed sections, each of which comprises 1 rotating and 1 stationary disk, each provided with suitable knives or bars, the power consumption for a given strength development on bleached sulfate stock being about $\frac{1}{4}$ that required in an ordinary beater. The action of the beater roll is discussed to show how the vertical beater gives a proportionately much faster hydration and lower cutting effect than the Hollander type of beater. A. P.-C.

Effect of beating on the sizing strength of paper. J. BERGER. *Papier-Fabr.* 26, 5(1928).—See C. A. 23, 702, 3090. R. H. DOUGHTY

Beating in the hollander. WILH. GRÜTZSKY. *Papier-Fabr.* 27, 149-54(1929).—A discussion of the beater action and exposition of Ger. pat. 457,407. This describes a perforated beater roll in which a vacuum is applied ahead of the bed plate completely to fill the cells with pulp, and pressure applied across the bed plate and backfall section to force all the pulp in the cells against the bed plate knives and to force complete discharge over the backfall. This should give much increased power efficiency in the beater. R. H. DOUGHTY

The determination of chlorates in bleaching-hollander liquors. HERBERT PRELINGER. *Zellstoff Papier*, 8, 294-5(1928).—Excessive chlorate formation in bleaching indicates over-heating, and hypochlorite so consumed is wasted. Lunge's method for chlorates (reduction with excess FeSO_4 and detn. of the excess by KMnO_4) fails in waste bleach liquors because of the org. matter present. The following method of detn. is accurate to 0.03%, with a chlorate content of 0.5 gm. per l., and is unaffected by org. matter: With chlorates alone, reduce with SO_2 (reduction is instantaneous on warming), boil off the excess rapidly, add an excess of 0.1 N AgNO_3 and a few drops of HNO_3 , filter, wash, det. AgNO_3 in the clear filtrate by Volhard's method, and compute chlorate Cl by difference. If chloride is present, it is detd. first, then total Cl added on a sep. sample, after decompn. with SO_2 , and chlorate Cl found by difference. If hypochlorite is present, it is decompd. by alk. H_2O_2 , the excess H_2O_2 destroyed by boiling, and the procedure carried through as in the presence of chloride. R. H. D.

Influence of "Saftbraun" dyeing on the strength of paper. A. SCHLATTER. *Papier-Fabr.* 27, *Fest. u. Auslands-Heft*, 94-5(1929).—"Saftbraun" is obtained by treating a mixt. of brown coal and ocher with soda. When used for dyeing rough papers, the strength of the paper at first increases and then falls off. The following results were obtained with 0, 6 (max. strength) and 15%, resp., of dye: breaking length, m., 3644, 6800, 2431; Mullen bursting strength, kg., 1.5, 2.6, 1.9. The increase in strength is ascribed to the impregnating and binding effect of the dye. R. H. DOUGHTY

Production of waterproof tints in tissue papers by means of acid dyes. A. LANDOLP. *Papier-Fabr.* 27, 357(1929).—Acid dyes are preferred for the web dyeing of tissue and crepe papers since they may be obtained in brilliant and light-fast colors. They, however, run badly if wet. Investigation has disclosed that certain of these dyes, several of which are listed, do not form a lake when 400 cc. of 5% AlAc_3 is mixed

with 1000 cc. of 1% dye soln., and that sheets dipped in such a mixt. are dyed water fast. The test of fastness is that the dry sheets upon soaking for 10 min. in distd. H_2O do not color the water, and are unchanged in tint when redried. A rather strong drying is necessary for good fixation. Sheets colored in this way are somewhat harder in feel than normal, which is also an advantage.

R. H. DOUGHTY

Goldenrod shades on paper. J. A. MELTZER. *Paper Maker & Brit. Paper Trade J. International No.*, 96(1929).—Methods are given for using the following National dyes for productions of goldenrod shades: Solantine yellow FFP conc., Erie yellow YP, Erie yellow S2GP conc., Erie yellow SGP, Erie yellow SRP conc., Metanil yellow P conc. and Auramine OP conc.

A. PAPINEAU-COUTURE

The whiteness of paper. L. BLIN DESBLEDS. *World's Paper Trade Rev.* 92, 754-8 (1929).—A brief description of the photolec photocolorimeter for detg. the whiteness of paper.

A. PAPINEAU-COUTURE

Slime prevention and shrinkage. D. K. PATILLO. *Paper Mill* 52, No. 38, 18, 26 (1929).—A brief discussion of the harmful effects of slime in paper making and of the advantages of preventing slime formation by appropriate chlorination treatment. An important advantage is the possibility of using a closed white-water system, particularly in conjunction with suitable coagulating treatment, for which purpose chlorinated copperas, Na aluminate and alum are particularly suitable.

A. PAPINEAU-COUTURE

Shrinkage. AUBREY T. TAYLOR. *Paper Trade J.* 89, No. 14, 84 5(1929).—A brief outline of the shrinkage loss at the mill of the Bedford Pulp and Paper Co., Big Island, Va., and reduction by installation of save-alls and reduction of the amt. of fresh water used on the paper machine showers. Measurement of the mill effluent and detn. of its fiber content accounted for all but about 3% of the shrinkage.

A. P.-C.

White water. A. W. PESCH. *Paper Mill* 52, No. 40, 16, 31(1929).—A brief discussion of the importance of white water losses and the methods of evaluating them.

A. PAPINEAU-COUTURE

Agents for washing and cleaning (paper-machine) felts and wires. AUGUST NOLL. *Papier-Fabr.* 27, 154-7(1929).—The compn. and recommendations for use of 20 trade-named materials are given.

R. H. DOUGHTY

Chemical determination of wool in felt papers. BRUNO SCHULZE. *Papier-Fabr.* 27, 299-301; *Wochbl. Papierfabr.* 60, 545 7; *Zellstoff Papier* 9, 610 11(1929).—Microscopic estn. of wool fiber is very difficult. Two gravimetric methods are in use in the industry, in which either the wool is dissolved in 2% NaOH (I) or the non-wool fibers are dissolved in 80% H_2SO_4 (II), the insol. residue being weighed. Both methods were tested on various pure fibers and on known mixts. of fibers. The results of I were invariably several percent too high; the error with II was less than 0.5%, except with pure jute (0.8% high) and mech. pulp (2.1% high). The method is as follows: A 10-g. sample is boiled with water to sep. the fibers, filtered on a fine mesh wire, shaken with 96% alc., filtered as rapidly as possible and treated with 300 cc of 80% (60.9° Bé.) H_2SO_4 in a stoppered flask. The mass is shaken for an hr. with brief pauses and at 15 min. intervals for 2 hrs. more, dild. with a l. of water, and filtered through a fine wire cloth. The wool residue is washed with dil. alkali, with water until neutral, and dried at 100-105°. The weight obtained must, in industrial work, be corrected for ash content.

R. H. DOUGHTY

Paper stock feed regulators. JOSEPH ROSSMAN. *Paper Trade J.* 89, No. 7, 63 74 (1929).—A review of U. S. patents.

A. PAPINEAU-COUTURE

Kolitsch automatic stock feed regulator. AUGUST KOLITSCH. *Paper Trade J.* 89, No. 8, 54(1929).—A description of U. S. pat. 1,695,380 (C. A. 23, 983).

A. P.-C.

The Van de Carr consistency regulator. C. R. VAN DE CARR, JR. *Paper Trade J.* 88, No. 23, 66-7(1929).—A description of U. S. pat. 1,665,425 (C. A. 22, 1854).

A. P.-C.

Stock loss determinations. D. S. DAVIS. *Paper Ind.* 11, 647(1929).—An alignment chart is given which may be used to calc. stock losses from white water weir and consistency measurements.

A. PAPINEAU-COUTURE

The manufacture and use of rubber rolls (for paper machinery). GUSTAV BECKER. *Papier-Fabr.* 27, 171-7(1929).—Descriptive, with illustrations.

R. H. DOUGHTY

Lubricants for paper mills. ERNST W. STEINITZ. *Papier-Fabr.* 27, 268-72(1929).—The importance of adopting proper lubricants (with specifications) for various uses is emphasized.

R. H. DOUGHTY

A new gum-coating machine. ARTHUR B. GREEN. *Paper Trade J.* 89, No. 8, 45-7 (1929).—The drawbacks of the festoon dryer and of the Crowell dryer are briefly discussed. They have been overcome by designing a double-loop dryer in which the paper after gumming is carried over 2 wheels, 20 ft. in diam., which are completely enclosed

in a highly insulated, uninterrupted, tight construction, affording the max. thermal efficiency.

Apparatus for testing paper machine wires. RENÉ ESCOURROU. *Papier* 32, 409-13; *Paper Trade J.* 89, No. 3, 59-61(1929).—An app. is described in detail by which, in comparing samples of different wires, the loss in wt. is detd. The loss in draining qualities of the wire at any given stage in the test can be detd. by measuring the rate of flow of a standard vaseline oil and comparing it with the rate of flow for the same wire before the test.

A. PAPINEAU-COUTURE

Recovery and reuse of mill effluents. R. H. CLAPPERTON. *World's Paper Trade Rev.* 92, 142-6(1929).—A brief description of the Marx funnel filter (sedimentation save-all) and discussion of its merits.

A. PAPINEAU-COUTURE

Corrosion-resistant steels for the (paper) industry. JOHN A. MATTHEWS. *Paper Trade J.* 88, No. 21, 79-81(1929).—Tests carried out on upwards of 20 different alloys (both ferrous and non-ferrous) by total immersion in com. sulfite liquor during periods extending from 10 to over 100 cooks (150-2800 hrs) showed that: the non-ferrous metals, as a class, so far as yet tested, are unsatisfactory and by no means equal to several of the ferrous alloys; some of the ferrous alloys are unsatisfactory, but of the ferrous alloys the range of analyses covered showed conclusively that a high Cr content, such as a stainless steel of 24% Cr, is extremely resistant; a high Cr content with relatively low Ni content is also satisfactory; where the Ni is much higher than the Cr, the results are not satisfactory. The rate of corrosion in the satisfactory samples is best exemplified by saying that the rate of penetration was of the order of 0.01 in. in depth per yr. The max. rate of corrosion of a no. of stainless steels and of "rezistals" (highly resistant alloy steels made by the Crucible Steel Co.) by black liquor was of the order of 0.002 in. penetration per yr.

A. PAPINEAU-COUTURE

Analytical recognition of the metal-corroding power of papers. I. KALB AND F. F. VON FALKENHAUSEN. *Papier-Fabr.* 27, 330-3(1929).—It is shown that resin acids do not attack metals, the actual acidity of paper being the cause of such attack. All metals are not affected in the same way; Cu foil was used in this study, and the paper was considered satisfactory if the metal showed no attack after 10 weeks contact in an atm. of 90% relative humidity. Results obtained by extg. the paper and titrating the ext. showed no definite relation with those of the corrosion test. With the Wulff colorimeter foils it was shown definitely that papers with a p_H above 5 would not corrode Cu. Papers treated with known amts. of ZnS attacked Cu readily, but if equal amts. of ZnO were added, the attack was entirely prevented. The crit. p_H in the S-contg. papers was not established, but it, and not titrable acidity, is the controlling factor in the corrosion of metals by papers.

R. H. DOWGITY

Determining the transluence of paper. W. HOLWECH. *Paper Trade J.* 89, No. 10, 55-8; *Papier-Fabr.* 27, 37-45(1929).—A math. theoretical discussion of the absorption of light by paper, with an explanation of the use of the König-Martens polarization photometer for measuring the absorption coeff.

A. PAPINEAU-COUTURE

The measurement of the contrast ratio of opaque and translucent papers. JAMES D'A. CLARK. *World's Paper Trade Rev.* 92, 996-1004(1929).—The "contrast ratio" is considered to be the best measurement to est. the printing quality of paper. The U. S. Bur. of Standards instrument for detg. it is suitable for papers of which the contrast ratio is not much above 0.85 (about the ratio for a medium wt. bond); but for more opaque papers the range of 0.85-1.00 is covered by only 2.3° of arc, and as most newsprint papers lie between 0.90 and 0.95, or only 0.9° of arc, the method is unsuitable for accurately measuring their opacity. The following simple and convenient method has been devised for measuring the contrast ratio of opaque papers: A piece of paper, made from materials which change very little, the color and texture of which approx. to the av. of samples to be tested, and having a contrast ratio of about 0.85, or slightly greater, is selected as a substandard (a fairly opaque, dull-colored bond paper of slightly yellowish cast is very suitable). Its contrast ratio is very accurately detd. by the ordinary method with a large no. of readings. A special attachment to replace the black and white areas of the Bur. of Standards instrument by a uniformly illuminated glass screen is inserted and the substandard, together with the sample to be measured, is placed in the holder of the instrument so that each paper covers one-half of the photometer field. If the fields are matched by rotating the arm of the photometer and the sample has the same opacity as the substandard, the setting of the instrument will be 45°, and if the sample were perfectly opaque the reading would be 9°. If the substandard has a contrast ratio of 0.86, the range 0.86-1.00 is thus covered by 45° of the photometer scale, instead of about 2.2° by the usual method.

A. PAPINEAU-COUTURE

Manufacture of safety paper. J. ROSSMAN. *Papier-Fabr.* 27, 295-9(1929).—Summary of U. S. patent literature; cf. C. A. 22, 4813. R. H. DOUGHTY

The buffer process for sized liner paper board. A. W. WICKHAM AND R. W. SHAFFER. *Pulp Paper Mag. Can.* 27, 920-1; *Paper Trade J.* 88, No. 24, 92, 94; *Paper Mill* 52, No. 25, 5, 37(1929).—The process is intended primarily for prevention of desizing of the liner, and consists essentially in maintaining a slight acidity of the stock in the vat next to the liner by adding alum (by means of a dry feeder) to the stock forming the ply next to the sized liner, the alum being added preferably at the screen. The advantages claimed are: It prevents entrance to the liner of the alk. water squeezed from the filler plies at the presses, thus preventing desizing of the liner; it produces a freeing action of the stock, thereby making it possible to dry the board more readily; the flocculent $Al(OH)_3$ pptd. on addn. of the alum entrains such of the size-alum ppt. as was made in the beater but which was not firmly attached to the fibers of the liner stock, thus enhancing sizing efficiency; it gives more uniform sizing, decreased cost of sizing, better formation, increased strength, more uniform color and increased production. A. PAPINEAU-COUTURE

Insulating board from corn stalks. WARREN E. EMLEY. *Paper Trade J.* 88, No. 25, 61-2(1929).—A brief outline of the semi-com. exptl. work carried out by the U. S. Bureau of Standards, in cooperation with Iowa State College, during the last 2 yr. A. PAPINEAU-COUTURE

The use-requirements of chip board. G. R. WYMAN AND R. A. WILKINS. *Paper Trade J.* 88, No. 22, 43(1929).—A brief outline. A. PAPINEAU-COUTURE

A study of fiber wall boards for developing specification standards. B. W. SCRIBNER AND F. T. CARSON. *Paper Trade J.* 89, No. 13, 61-8(1929).—Results are given of a study of vegetable fiber wall boards undertaken by the Paper Section of the U. S. Bur. of Standards in connection with the formulation of purchase specifications for this product. Suggestions based on the tech. information compiled are made to assist those who wish to write purchase specifications for fiber wall boards. One specification covering both laminated and homogeneous boards appears to be feasible. The properties considered important in evaluating the quality of the boards are strength, water absorption and expansion; and from consideration of the av. quality of com. brands in use, as shown by lab. data, the following requirements are suggested: flexural bending strength not less than 10 lb. for the shorter direction of the board; water absorption not more than 65% of the original wt. of the board; expansion not more than 0.7% in the shorter direction of the board. The methods to be used for testing are described. These requirements are well within the limits of most of the com. products in use at the present time and are believed suitable for the purchase of boards of good av. quality. A. PAPINEAU-COUTURE

Essential requirements of test liner for making a satisfactory container. H. C. McDANIEL. *Paper Trade J.* 88, No. 22, 48-9(1929).—A discussion of the essential properties of test liners: caliper, wt. per 1000 sq. ft., finish, Mullen test, tensile strength, waterproofness, folding quality. A. PAPINEAU-COUTURE

Requirements for fiber containers in service. C. A. PLASKETT. *Paper Trade J.* 88, No. 22, 46-8(1929); *Pulp Paper Mag. Can.* 28, 367-8, 382-6(1929).—A discussion of the causes of failure of fiber containers and of the qualities required to withstand these causes; also of the effects of scoring processes and of sealing processes on the strength of fiber boxes. A. PAPINEAU-COUTURE

The properties of corrugating board for satisfactory use in fiber containers. WILSON W. GALLOWAY. *Paper Trade J.* 88, No. 23, 68(1929).—The qualities necessary in a sheet of corrugating straw board to make it successful in use are: well-made roll, stiffness, ability to take steam, tensile strength, ability to hold silica, ability to bend in the arch without cracking, proper wt. per 1000 sq. ft., proper H_2O content and proper caliper. A. PAPINEAU-COUTURE

Causes and prevention of deterioration in book materials. ROBERT P. WALTON. *Paper Trade J.* 89, No. 6, 53-8(1929).—See C. A. 23, 3343. A. PAPINEAU-COUTURE

Disposal of industrial wastes (RUE) 14. Waste heat in cement mills and paper mills (SMITH) 20.

Cellulose from highly lignified plants such as bamboo or beechwood. ROLAND RUNKEL (to Verein für Chemische Industrie A.-G.). U. S. 1,731,112, Oct. 8. The raw material is comminuted and chemically softened (suitably by treatment with alkali soln.) at atm. pressure, chemically reduced to fiber, and the fibers are subjected to successive multi-stage oxidation and chlorination, as by treatment with gaseous Cl_2 .

Cellulosic fiber liberation. GEORGE A. RICHTER (to Brown Co.). U. S. 1,730,383, Oct. 8. Raw cellulosic material such as wood is digested under fiber-liberating conditions in a sulfurous acid soln. contg. Na-B salts, such as borax, which serve to facilitate production of high-grade pulp and regeneration of the liquor.

Apparatus of the Jordan type for refining fiber stock. JOHN A. WIENER. U. S. 1,730,908, Oct. 8. Structural features.

Conditioning cellulose for production of derivatives such as nitrocellulose. GEORGE A. RICHTER, MILTON O. SCHUR and ROYAL H. RASCH (to Brown Co.). U. S. 1,729,628, Oct. 1. Wood pulp is beaten to about the slowness of pulp used in bond paper manuf. preliminary to its conversion into derivs. such as nitrocellulose for films, lacquers, artificial silk, etc. The preliminary treatment serves to facilitate production of "lower" nitrated cellulose of desired properties. U. S. 1,729,629 specifies removing fine, short and broken fiber from pulp, deresinifying and cleansing the removed material, and nitrating.

Refining raw wood pulp. MILTON O. SCHUR (to Brown Co.). U. S. 1,730,386, Oct. 8. A lime-digested pulp is deresinified and then bleached.

Processing cellulosic fiber. MILTON O. SCHUR and ROYAL H. RASCH (to Brown Co.) U. S. 1,730,387, Oct. 8. Cellulosic material such as wood pulp freed from encrusting substances is treated with org. solvents such as alc. and CCl_4 to remove resinous impurities. An arrangement of app. is described.

Bleaching chemical wood pulp. LINN BRADLEY and EDWARD P. MCKEEFE (to Bradley-McKee Corp.). U. S. 1,730,315, Oct. 1. Pulp in a flowing condition and contg. only a small quantity of cellulose material in a large quantity of water is brought into direct contact with gaseous Cl and permitted to flow through an atm. of Cl. An app. is described.

Apparatus for straining pulp fibers. LEMUEL B. DECKER. U. S. 1,731,193, Oct. 8. Structural features.

Paper manufacture. ARTHUR L. KENNEDY (to Plastic, Inc.). U. S. 1,730,009, Oct. 1. See Can. 280,789 (C. A. 22, 3045).

Impregnated paper hood caps for milk bottles, etc. CARLETON ELLIS. U. S. 1,731,194, Oct. 8. A single-ply skirted paper cap is made from paper stock contg. a considerable proportion of groundwood, and carries a binder of a quick-setting wax such as a wax and resin mixt. U. S. 1,731,195 also relates to skirted caps hot-crimped around the bottle rim and carrying a fusible material such as a wax and resin mixt., which gives sufficient adherence to the bottle for ordinary handling while permitting ready removal.

Paper hood cap for milk bottles, etc. CARLETON ELLIS (to Ellis-Foster Co.). U. S. 1,730,563, Oct. 8. The material is treated with a Mg stearate compn. or other water resistant binder contg. an insol. soap and substantially free from water-sol. soap. U. S. 1,730,564 specifies a hood cap of stiff paper crimped over the top of the bottle and impregnated with a mixt. of rosin, paraffin and carnauba wax or other binding compn., which, on undue rise in temp., loses its binding character, permits sepn. of the cap from the head of the bottle top and thus serves as an indicator of the bottle and contents having been exposed to temps. above those suitable for keeping milk and cream in good condition.

Multi-ply paper board. LEVIS M. BOOTH (one-third each to Almeron W. Wickham and Ralph W. Shaffer). U. S. 1,729,992, Oct. 1. In the manuf. of multi-ply paper board in which one or more of the liner plies are sized, acid material such as $\text{Al}_2(\text{SO}_4)_3$ is added to such of the filler stock as is supplied to the filler vat which is next to the liner vat prior to the delivery of the stock to the paper machine vat.

Electrical temperature-indicating device suitable for use on paper calendering rolls, etc. CHARLES B. THWING (to Thwing Instrument Co.). U. S. 1,730,308, Oct. 1. Structural features.

24—EXPLOSIVES AND EXPLOSIONS

CHARLES E. MUNROE

Symposium—explosives manufacture. *J. S. African Chem. Inst.* 10, No. 2(1927). Advances made in nitroglycerin manufacture at Modderfontein. G. F. AYERS. *Ibid* 3 5. These advances chiefly were the use of chilled brine in nitration, improvements in proportions and strength of nitrating acids and the use of accelerators and retarders in the after separation. **Acid pumping.** M. S. SALOMON. *Ibid* 6.—The acid egg and the

montejus have been replaced by direct-drive cast-iron centrifugal pumps for mixed acids, spent acids, oleum and H_2SO_4 down to 70%. For weaker H_2SO_4 the pumps are made of Ceratherm. For HNO_3 , pumps are made of an alloy of Pb and Sb. **Pure acid.** M. S. SALOMON. *Ibid* 7-9.—Pure acid is made from oleum by distn. in steel vessels. Surface cooling of this acid is discussed. **Recent developments in manufacture.** T. T. WOOD. *Ibid* 10 2.—Deals with HCl and salt cake, acid-resisting metals, condensation of HNO_3 , and the combined process of denitration of nitroglycerin waste acids and the concn. of weak HNO_3 . **The analysis of nitroglycerin waste acid.** A. S. WEBB. *Ibid* 13-4. **A thermohydrometer.** A. S. WEBB. *Ibid* 14-5.—This is constructed like the common hydrometer but the large bulb is filled with a colored liquid which rises or falls in the stem of the hydrometer with the changes in temp. **Advantages of displacement over the dipping process for the nitration of cotton.** D. I. ALLAN. *Ibid* 16 7. **The estimation of azides.** D. A. COPEMAN. *Ibid* 18 22.—The azide is treated with a soln. of ceric ammonium nitrate and the N set free is collected in an azotometer. **Contact processes—sulfur and pyrites burners.** W. J. P. SUTHERLAND. *Ibid* 23-6.—A general review of known practice. CHARLES E. MUNROE

Developments in the explosives industry in Great Britain during 1927 and 1928. JOHN WEYR. *Z. ges. Schiess Sprengstoffw.* 24, 218 9(1929).—The article is a brief résumé of progress in development of *initiating explosives*, *industrial explosives*, *military explosives* and in the *testing of explosives*. The increased use of PbN_3 in detonators and of *glycol nitrate* in low-freezing dynamites is especially noted. C. G. STORM

Seventh annual report of the Safety Mines Research Board for 1928. EDWARD TROUP, et al. *Safety Mines Research Board (London) 7th Annual Rept 1929*, 88 pp.; *Colliery Guardian* 139, 906-10(1929).—The amt. of volatile matter in a coal is a rough measure of the relative flammability of its dust as detd. by the amt. of incombustible dust necessary to mix with it to suppress ignition. With high-volatile coals each % of fire damp in the air required that the amt. of incombustible dust to suppress ignition be increased by 5%; with low-volatile coals the effects of the presence of fire damp were more marked. For a lab. test of flammability a mixt. of coal dust and inert dust, both of standard fineness, is blown by a puff of O through a vertical furnace at 700°. Flammability depends mainly upon reactivity of the ulmin constituents of coal. Coal dust blown by a fan into an insulated metal pipe gives the latter a high charge, and sparks therefrom may ignite fire damp. Small traces of NO_2 lower considerably the ignition temp. of CH_4 . The hot, gaseous product from explosives may be of importance here. High-frequency vibrations from a CH_4 flame may raise a cloud of dust. If a constriction be in the flame path, very high pressures can occur. E. M. SYMMES

The explosive properties of "Chloratite 3" with varying content of petroleum. A. HAID AND H. SELLE. *Z. ges. Schiess-Sprengstoffw.* 24, 251 2(1929).—The petroleum content of this *chlorate explosive* was varied from 0 to 16%, and the effect measured by detns. of sensitiveness to impact, by transmission of detonation through air gap, by rate of detonation, and by the effect on Pb blocks and Cu cylinders. From a summary of the results of all tests it is concluded that the most favorable content of petroleum is 8.9%. C. G. STORM

Ignition of fire damp. H. F. COWARD AND R. V. WHEELER. *Safety Mines Research Board (London) Paper No. 53*, 40 pp (1929).—Mixts. of fire damp and air of suitable compn. ignite when a sufficient vol. is kept at sufficient temp. for a sufficient time. These 3 factors are dependent upon one another, e. g., a mixt. raised to ignition temp. may be unaffected for 10 sec., then ignite suddenly. The question as to which is the most easily ignitable mixt. of CH_4 and air can be answered only when the means of ignition are specified. Heated surfaces are less dangerous than lamp flames. Elec. sparks are the more dangerous the more rapidly their energy is communicated to the flammable mixt. Capacity sparks are more dangerous than inductance sparks, and a. c. and d. c. act alike. E. M. SYMMES

Ignition of fire damp by the heat of impact of metal against rock. M. J. BURGESS AND R. V. WHEELER. *Safety Mines Research Board (London) Paper No. 54*, 25 pp (1929); cf. C. A. 22, 3047; 23, 935.—A steel block pressed against a revolving Carborundum wheel did not ignite fire damp but did fire CS_2 and thin tissue paper. A steel block pressed against a steel wheel driven by 5 h. p. gave no ignition. Fire damp ignited from the heated edge of a steel rod pressed against a rapidly revolving wheel of hard quartzitic sandstone driven by 1-1.5 h. p. Other hard rocks caused no ignition. A 12" cutting disk with 40 W steel cutters gave ignition with certain rocks; this was not to sparks but to heated areas. Coal-cutter picks on the periphery of a rapidly revolving wheel caused ignition for the same reason. A chain coal-cutter cutting hard rock gave ignitions at a cutting speed of 0.75-18" per min., depth of cut 3-5". E. M. SYMMES

The danger of fire and explosion with acetylene. W. RIMARSKI. *Z. angew. Chem.* **42**, 933-6(1929).—The Borsigwalde fire and explosion were due to a leak in the filler manifold, which ignited by elec. spark, casting no reflection upon the safety of C_2H_2 cylinders in use at present. The latter have, in Germany, stricter supervision than in other countries. Details of routine tests and past inflammability investigations are given.

E. M. SYMMES

Dissolved acetylene. I. W. RIMARSKI. *Chem.-Ztg.* **53**, 725-7(1929).—A description of the official tests of C_2H_2 containers.

E. M. SYMMES

The quenching of flames in atmospheres of a certain composition and at the limits of explosion regions. W. P. JORISSEN AND B. L. ONGKIEHONG. *Rec. trav. chim.* **48**, 1069-74(1929); cf. *C. A.* **21**, 1215.—A continuation of J. and O.'s investigations on explosion regions. Curves are given showing the explosion regions of H_2 -air- CO_2 , CO -air- CO_2 , CH_4 -air- CO_2 , C_2H_4 -air- CO_2 , C_2H_2 -air- CO_2 , N_2 - O_2 - NH_3 and N_2 - O_2 - C_2H_5Br mixts., in which the O_2 contents of the atms. were detd.

H. W. LEAHY

The recovery of solvents in powder factories. OTTO KREBS. *Z. ges. Schiess-Sprengstoffw.* **24**, 215-8(1929).—An app and method for the recovery of $EtOH$ and H_2O in the drying of smokeless powder are described. The solvent is removed from the powder by an air current heated to 50° , the vapors being absorbed by H_2O in washers and recovered in distn. app.

C. G. STORM

Chromic acid combustion of organic compounds, especially of nitro and amino compounds (FRIEDEMANN) 7. [Explosion in] the mining of gilsonite in Utah (FENG) 8. Centrifugal casting—adaptability to high-explosive steel shells (PAINE) 9. The preparation of hydrazoic acid and its salt (HOTH, PHYL) 18. Safety precautions for preventing the explosion of digesters (ANON.) 23.

25—DYES AND TEXTILE CHEMISTRY

L. A. OLNEY

Laboratory fastness tests for dyestuffs. KENNETH MARSDEN. *Dyer, Calico Printer* **62**, 259, 313(1929).—Simple practical tests are described for testing fastness to mulling, washing, light, chlorine, acids, alkalis, potting and stoving.

R. K. W.

The analytical quartz lamp as an aid in textile testing. A. SOMMER. *Wochbl. Papierfabr.* **60**, 9-13(1929).—Various uses for the lamp are outlined, and a list of the fluorescent colors of various fibers is given. The fluorescence in ultra-violet light of vegetable fibers depends upon the kind and amt. of incrustants present, and therefore may be useful in identifying types of fibers, or in measuring the degree of bleaching or detecting over-bleaching. It may also be of use in testing dyes. Unfortunately its use has not been sufficiently studied as yet to permit more than limited and qual. application.

R. H. DOUGHTY

Application of cutch and protection of vegetable fibers against marine influences. JAMES W. DURANT. *Dyer, Calico Printer* **62**, 133-5, 217(1929).—The use of linseed oil, mixts. of wax and oil, and of waxes and various emulsions as protective agents is described.

RUBY K. WORNER

How rayon may be successfully processed in the bleachery. THOMAS F. HUGHES. *Textile World* **76**, 1155-6, 1177(1929); cf. *C. A.* **23**, 701.—Practical.

R. K. W.

The mercerization of cotton goods containing artificial silks. A. J. HALL. *Ind. Chemist* **5**, 355-7(1929).—See *C. A.* **23**, 5323.

E. G. R. ARDAGH

Sunn hemp. S. D. TIMSON. *Rhodesia Agr. J.* **26**, 668-82(1929).—*Crotalaria juncea* was studied thoroughly. The av. Sunn hemp crop is about 10 tons per acre and contains 53% H_2O . The dry matter of the entire plant contains N 2.31, P_2O_5 0.26 and K_2O 1.26%. The compn. of the seed is: H_2O 8.6, protein 31.2, other compds. contg. N 3.4, fat 4.3, starch 41.1, fiber 8.1 and ash 3.3%. The seed does not contain cyanogenic glucosides but gives reactions suggesting the presence of some unidentified alkaloid.

A. L. MEHRING

Determination of wool shrinkages by sample scouring. J. F. WILSON. *Textile World* **76**, 1463-5(1929).—A system of scouring small samples of wool has been devised which gives results comparable to the usual 3- or 4-bowl scouring vat. The wool is put through a cone-type duster 3 times to open the tip and thus facilitate the penetration of the bath. For the scourings, 5 Cu trays fitted with hot and cold water, gas and drain are used. A smaller tray with a screen bottom drops into the larger tray. In between "baths," the sample is put through a heavy laundry wringer, and the process is repeated

until the wool is scoured. A new type of drier, especially designed to handle small quantities of scoured wool, has been developed. The device employs a combination of centrifugal force and hot air blast. Three to 5 min. is required for reducing a 100 to 125 g. sample from complete satn. to less than air dryness. RUBY K. WÖRNER

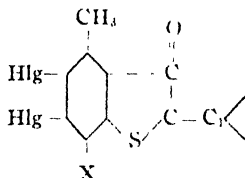
The application of the azoic colors to wool and union goods. J. A. WALLWORK. *Dyer, Calico Printer* 62, 190-1, 277 (1929).—Directions and formulas are given.

RUBY K. WÖRNER

Influence of "Saftbraun" dyeing on the strength of paper (SCHLATTER) 23. A special case of syneresis [in dye preparation] (JACOBY) 2. Fast colors for leather (LAMB) 29. Chemical determination of wool in felt papers (SCHULZE) 23. Dye composition for leather (U. S. pat. 1,729,938) 29. Ketones of the anthracene series [for dye production] (U. S. pat. 1,730,081) 10. Rubber-coated fabric suitable for ornamenting cloth (U. S. pat. 1,730,665) 30. Waterproof wrapping cloth (U. S. pat. 1,729,681) 13. Mo phosphotungstate compounds (for lake manufacture) (U. S. pat. 1,731,081) 18.

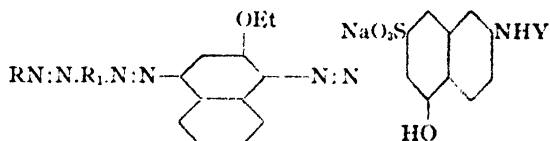
Indigoid dyes. ERWIN HOFFA, HANS HEYNA and FRITZ MÜLLER (to General Aniline Works). U. S. 1,730,209, Oct. 1. A 4,5,6,7-tetrahalo-3-hydroxy-1-thionaphthene is condensed with a cyclic α -diketone such as 5,7-dichloroisatin. Dyes thus formed, which are described, give brown and violet tints on cotton.

Vat dyes. HERMANN WAGNER, RUDOLF BRÜNE, MAX HESSENLAND, ERWIN HOFFA, FRITZ MÜLLER and HANS HEYNA (to General Aniline Works). U. S. 1,730,699, Oct. 8. Several examples are given of the production of dyes giving fast blue, violet or brown dyeings on cotton and having the general formula



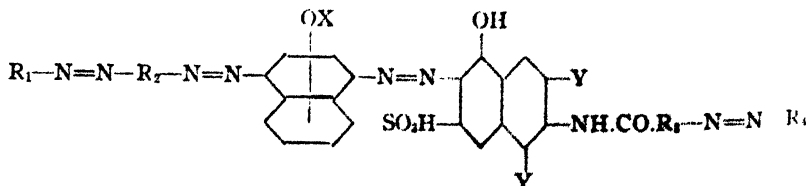
wherein C_1 represents a C atom belonging to the 5-membered nucleus of an isatin compd. and X represents H which may be replaced by halogen. These dyes are obtainable by condensing 4-methyl-5,6-dihaloxythionaphthene with an isatin compd. and halogenating the reaction product if desired.

Trisazo dyes. HUGO SCHWEITZER and JOHANN HUISMANN (to General Aniline Works, Inc.). U. S. 1,730,692, Oct. 8. Dyes of the general formula:



wherein R and R_1 represent aryl nuclei and Y represents H or an aryl nucleus are obtained by coupling the diazo compd. of a secondary disazo dye contg. in the end position the radical of a 1-amino-2-naphthol ether with a 2-amino-5-naphthol-7-sulfonic acid compd. They are generally dark powders sol. in water with a bluish green and in concd. H_2SO_4 with a blue coloration, dyeing cotton in clear greenish blue shades of good fastness.

Tetrazisazo dyes. WINFRID HENTRICH and MAX HARDTMANN (to General Aniline Works). U. S. 1,730,207, Oct. 1. Numerous examples are given of the production of dyes of the general formula



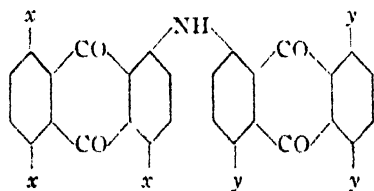
wherein R_1 and R_2 represent aromatic residues, R_3 represents a residue of the naphtha-

lene series, R_4 a residue of any suitable end component, XH , an alkyl or acyl group and YH or any univalent substituent. They dye cotton fast, clear green shades.

Yellow monoazo dyes. HERMANN WAGNER and ERICH FISCHER (to General Aniline Works). U. S. 1,730,179, Oct. 1. By coupling a diazo compd. from an aniline-sulfonic acid with 1-(2'-chloro-5'-sulfophenyl)-3-methyl-5-pyrazolone yellow monoazo dyes are obtained which are readily sol. in water and dye wool very even tints fast to water. The dycings are of clear green fast to light. Several examples are given.

Yellow dyes for wool. EMILE REBER and JOSEPH SPIELER (to Soc. anon. pour. l'ind. chim. à Bâle). U. S. 1,731,150, Oct. 8. Azo dyes of the general formula: acidyl-NH—R—N=N—P where in R means an aryl nucleus of the benzene series which contains a sulfonic group in *o*-position and the acidyl-NH group in *m*-position to the azo group, and wherein P means the residue of a 1-aryl-5-pyrazolone, are obtained by coupling diazo compds. of the general formula: acidyl—NH—R—N=N—OH, wherein R has the above mentioned signification, with 1-aryl-5-pyrazolones, form yellow to brown and orange-yellow powders, dissolving in water on addn. of Na_2CO_3 soln. with yellow color, and dye wool in equal yellow tints which are of good fastness to alkali and light. According to the choice of the components, dyes are obtained which are fast not only to water but also to acid fulling and to alkali and, under certain conditions, have good fastness to washing. Even the 1-aryl-5-pyrazolone-3-carboxylic acids, which have yielded hitherto azo dyes of color strength but only moderately equalizing power, give rise to products which are excellently equalizing and fast.

Cotton dyes of the anthraquinone series. FRITZ BAUMANN (to General Aniline Works). U. S. 1,730,186, Oct. 1. Several examples are given of the production of dyes having the general formula:



wherein one x and one y stand for benzoylamino groups, at least one x or one y for an alkoxy group and the remaining x 's and y 's for H, well-crystg. compds., sol. in concd. H_2SO_4 with a generally dull olive-green to blue-gray color, which changes soon into a red-brown to orange red to red color.

Resists used in dyeing. JULIUS HÖPKER (to General Aniline Works). U. S. 1,730,211, Oct. 1. The material to be dyed is printed with a mixt. of an oxidizing agent such as $Na_2Cr_2O_7$ or Na *m*-nitrobenzenesulfonate and an aq. soln. of a methyl ether of cellulose, dried, and dyed in vat liquor.

Apparatus with perforated pipes for dyeing thread packages. CHARLES K. DUNFORD (to Sonoco Products Co.). U. S. 1,730,320, Oct. 1. Structural features.

Apparatus for dyeing or treatment of yarn in skeins. NOAH WALKER and EUGENE H. DAVIS (to Walker & Davis, Inc.). U. S. 1,730,025, Oct. 1. Structural features.

Soap baths for treating textile materials. FRITZ GÜNTHER and JOSEPH NÜSSLEIN (to I. G. Farbenind. A.-G.). U. S. 1,730,037, Oct. 1. A naphthalenesulfonic acid contg. alkyl groups with at least 3 C atoms, e. g., isopropyl-naphthalenesulfonic acid, is used in soap baths for the purpose of increasing their wetting and penetrating power in dyeing or other processes.

Treating vegetable, animal or artificial fibrous materials with emulsions, spinning oils or fats, etc. JOHANN G. KÄSTNER. U. S. 1,730,430, Oct. 8. A highly colloidal and highly viscous org. substance such as a tragacanth soln. or a decoction of carob bean kernels is added to the usual emulsions, spinning oils or fats.

Composition for impregnating balloon fabrics. ERICH TRECKMANN and BRUNO TRECKMANN (to Luftschiffbau Zeppelin, G. m. b. H.). U. S. 1,730,544, Oct. 8. Gelatin or a like substance is used with about an equal quantity of Turkey red oil, about 10 times its quantity of water and about half its quantity of glycerol.

26—PAINTS, VARNISHES AND RESINS

A. H. SABIN

The viscosity of oil paints. HANS WOLFF. *Farben-Ztg.* **34**, 2990-1 (1929).—The viscosity of a paint prepd. by thinning a stiff paste with oil is less than that of a paint prepd. by thinning a thin paste to the same percentage of oil and pigment. The difference is greater for paint contg. a relatively small amt. of oil. The crit. points (C. A. **23**, 5333) of both types of paint lie close together and may be considered a const. of the pigment. G. G. SWARD

Rust prevention by the use of oil paints: theoretical and practical considerations. J. HAUSEN. *Papier-Fabr.* **27**, 103-6 (1929).—A general discussion of the importance and the mechanism of the protection of iron work by paints. Five years is given as the av. life of paint coatings at present. The nature and phys. structure of the pigment particles play an important part in the formation of a protective film, a variety of sizes being better than a uniform size, and rough or irregular particles being better than smooth round ones, from the viewpoint of effectiveness and permanence of the coating. Brief mention is made of testing methods in use. R. H. DOUGHTY

Determination of zinc oxide in paints. EDWARD J. DAVIS. *Chemist-Analyst* **18**, No. 4, 11 (1929).—Boil 1 g. of pigment with 50 cc. of satd. NH_4Cl soln. and 35 cc. of 15 N NH_4OH for 5 min. Test the residue for Zn. Titrate the filtrate, which usually contains all of the Zn, with $\text{K}_4\text{Fe}(\text{CN})_6$. W. T. H.

Oil absorption of pigments. W. VAN WÜLLEN-SCHOLTEN. *Farben-Ztg.* **34**, 2940-1 (1929).—W. conducts the Gardner-Coleman method with a glass rod instead of a spatula. Some typical results are given. G. G. SWARD

Chalk as a pigment and paint component. E. O. RASSER. *Kunststoffe* **18**, 177, 9, et seq. (1928).—In the literature only scattered examples of the usefulness of chalk for paint and pigment are found. The color tone of chalk inclines toward gray or yellow, owing to the presence of org. substances which cannot be removed by any means except by ignition and of a slight amt. of Fe oxide. The yellowish color due to iron oxide can be neutralized by the addn. of a suitable quantity of a blue pigment. Formulas are given for the prepn. of various paints. B. HAMILTON

Pigments from waste products. E. T. ELLIS. *Dyer, Calico Printer* **62**, 245, 9 (1929).—Suggestions are given for methods of prepg. the following substances from waste products: As_2S_3 , As_2S_5 , chrome red, chrome yellow, chromic arsenite, Cr_2O_3 , Cu arsenite, Emerald green (copper acetoarsenite), Fe_2O_3 , ferrous ferricyanide, manganic oxide, orpiment and Prussian blue. RUBY K. WERNER

Titanium dioxide and titanium white. C. P. VAN HOEK. *Farben-Ztg.* **34**, 2828-32 (1929).—The usefulness of Ti pigments in exterior paints is questioned because of the excessive chalking. TiO_2 itself should be used only in limited quantities as an ingredient of paints. 135 references are given. G. G. SWARD

Production of iron [oxide] colors. PETER P. BUDNIKOV. *Chem.-Ztg.* **52**, 846-7 (1928).—Magnetic oxide of Fe, produced as a by-product in the manuf. of aniline and α -naphthylamine, is a cheap raw material. After washing, heating for 1 hr. at 500-650°, and grinding, a brown-colored oxide is produced of poor covering power, but if the residues are treated with 40% of their weight of waste H_2SO_4 (70%) and heated for 2 hrs. at 750-800° the color and covering capacity are greatly improved. The higher the temp. of ignition the darker is the color. The stronger the acid used the tighter is the color. Mixts. with gypsum or heavy spar can be used as in the usual process for the production of Fe oxide colors. B. C. A.

Polymerization in the formation of linseed oil stand-oil. F. WILBORN AND F. KITTLER. *Farben-Ztg.* **34**, 2942-3 (1929).—The mol. wts. of stand oils were detd. by the Beckmann and the Rast methods and by a modified Rast method in which the m. p. of a mixt. of approx. 0.02 g. oil and 0.2 g. camphor in a 5 mm. closed tube was detd. While mol. wt. detns. were not considered capable of yielding complete information regarding the extent of polymerization, the last-named method was considered to be the most reliable. G. G. SWARD

Malayan lumbang oil. T. HEDLEY BARRY. *J. Soc. Chem. Ind.* **48**, 289-90T (1929).—The following consts. were found: sp. gr. 0.9264, I no. 150.8, sapon. no. 192.1, acid no. 0.66, unsapon. 0.41, n_D^{20} 1.4764. By adulterating China wood oil with lumbang oil and subjecting to the Brown heat test it was found possible to detect 10% or more of lumbang oil. In drying properties this oil compares favorably with linseed oil and is as good for paints on iron surfaces. On glass under lab. conditions this lumbang oil dried in 12 days as against 6 for linseed oil. A paint made up with Fe_2O_3 , china clay and

barytes when painted over a Pb primer on wood gave the same ratio of drying time as compared with a corresponding linseed oil paint, and the film was very soft after 3 weeks.

E. SCHERUBEL

Tung oil—particularly referring to the possibilities of production within the British Empire, with bibliography of the literature. L. A. JORDAN. *J. Soc. Chem. Ind.* **48**, 847-55(1929); cf. *C. A.* **23**, 4087.—Early in 1928 there was crushed 30,000 lb. of seed, mostly from the Florida plot. The best results were obtained with the Anderson expeller. Extn. processes were unsatisfactory. Tests of the product by consumers show it to be satisfactory. Since 1927 trial plots have been grown in Middle East Africa, India, Ceylon and New Zealand, some of which are promising.

E. M. SYMMES

Floor oils. WALTER OBST. *Allgem. Öl-Feltzg.* **24**, 699-700; *Chem. Zentr.* **1928**, I, 2227.—Mineral oil of d. 0.870-0.885 with 10% turpentine oil is most commonly used. To this mixt. may be added 5-8% of ceresin, stearin, or refined ozocerite. Hard drying oils are made by boiling wood oils with a Mn varnish with an equal quantity of either benzine or benzene. This material is particularly valuable for *calking*. A mixt. of linseed oil or wood oil is a valuable preserving agent for stone or cement floors.

C. R. FELLERS

Drying of dammar oil varnishes. C. KRAUZ AND V. KRACH. *Chem. News* **137**, 257 60(1928). Mixts. of equal parts of dammar resin and various oils (linseed, hempseed, locustseed, soy-bean, poppyseed and walnut) with varying amts. of driers were heated at definite temps. for varying lengths of time, and the varnishes so obtained were examd. for drying properties. The varnishes were the thinner the higher was the temp. at which they were prepd., while at the same temp. Co_2O_3 produced the thinnest and CoO the thickest products. The rate of drying increased with the temp. of heating up to a definite optimum, and again decreased as the temp. was raised further. The optimum temps. were situated between 175° and 275° , and the same drier usually required the same optimum temp. whatever oil was used. The I value of the original oil is only an approx. index of the rate of drying of the varnishes, locustseed-oil varnishes drying more quickly than linseed-oil varnishes. The acid and sapon. values decreased with rise of temp., duration of heating, and amt. of drier added. The optimum duration of heating was usually the shorter the higher the temp. used. The drier had a profound influence on the rate of drying. CoO was most efficient for oils of high I value, followed by MnO , Pb peroxide, red lead, Co_2O_3 , and PbO , but with oils of low I value PbO was best and CoO worst, while MnO was the best drier for poppy seed-oil varnishes and one of the worst for walnut oil. The optimum amt. of drier varied considerably, being usually the greater the higher was the optimum temp. The scraping test was applied to all varnish films, those prepd. at lower temps. being brittle while those prepd. at the optimum temps. were smooth and resistant.

B. C. A.

A method for the determination of the influence of water on varnish films. HANS KOPP. *Farben-Ztg.* **34**, 2892 3(1929).—Water or other liquid is placed in a Lind culture ring which has been cemented to the film with paraffin. An electrode (anode) is dipped into the liquid, the metal panel on which the film has been spread being the cathode. The cell is placed in series with a pencil lead, a moist starch iodide linen strip and a source of electricity. The starch iodide strip is caused to travel slowly below the pencil lead. When the film has become a conductor by imbibing the liquid a blue line is recorded on the strip. By means of a clock work and a relay the contact with the strip is made intermittently.

G. G. SWARD

Nature and constitution of shellac. II. Potentiometric titration in 95 per cent ethyl alcohol. WM. HOWLETT GARDNER AND WILLET F. WHITMORE. *Ind. Eng. Chem., Anal. Ed.* **1**, 205 81(1929); cf. *C. A.* **23**, 1762.—The analysis of various grades of shellac shows that in alc. soln. it acts like a weak org. acid and is slightly more acidic than other spirit sol. gums. Possibly the potentiometric titration may serve as a guide in such problems as the livering of paints.

W. T. H.

Boiling and evaporation rates of solvents and thinners for nitrocellulose lacquers. H. JORES. *Farben-Ztg.* **34**, 2886-92(1929).—Boiling ranges were detd. in an Engler app. Evapn. rates were detd. on 30 cc. liquid contained in a flat weighing glass 60 mm. diam. and 34 mm. deep. During weighing the glass was covered. Data on 65 solvents and mixts. are given. There is no definite relation between boiling ranges and evapn. rates.

G. G. SWARD

The constitution of artificial resins. JOHANNES SCHEIBER. *Chem.-Ztg.* **53**, 643 (1929); cf. Blumfeldt, *C. A.* **23**, 5179.—Polemical. HANS LEBACH. *Ibid.*—Polemical. A. E. BLUMFELDT. *Ibid.* 643.—Polemical.

W. C. EBAUGH

Light-rays and resinoids—a research problem. CHARLES W. RIVISE. *Plastics* **5**, 180, 211(1929).—The attempts of research workers to overcome the light sensitiveness

and the darkening of synthetic plastics are reviewed, also a no. of patents. The material may be given a finer color, greater tenacity and finer temper by subjecting it, after a prolonged mild heat treatment, to a higher temp. for a comparatively short time. For eliminating the orange or reddish color or tint often resulting from prolonged mild heat treatment, the heat treatment may be continued until the material is practically anhyd. and quite hard, followed by subjecting the block in a kiln to a temp. above 100° for several days. The addn. of 0.1% of the amt. of formaldehyde of hexamethylamine-tetramine in the soln. in the second stage of the process results in quick "setting." Concn. may be effected *in vacuo* and the hardening at atm. pressure, or at higher pressure, or at reduced pressure, or *in vacuo*. W. H. BOYNTON

Light and the resinoid plastics. CHARLES W. RIVISE. *Plastics* 5, 254-5, 266-8, 317-9(1929); cf. preceding abstr.—A résumé of what has been accomplished in the production of artificial resins resistant to light without material darkening. Brief analyses are given of certain patents relative to overcoming the main weaknesses of synthetic plastics. Several patents have been granted directed toward the utilization of photocondensation, photooxidation, photoresinification and photopolymerization in the decorating of metallic or other surfaces and the prepn. of screenless photolithographic plates and half-tone process plates and intaglio printing plates. W. H. BOYNTON

Action of zinc chloride on abietic acid. GEORGES ROTIN. *Bull. inst. pin* 1920, 251-2.—ZnCl₂ was found to act as a "cracking" catalyst toward rosin, yielding about 80% octahydrotetene, and probably also some higher hydrocarbons. The optimum proportion is 5%. It is almost impossible to operate *in vacuo*, because of excessive foaming. Best results were obtained by refluxing at atm. pressure for about 2 hrs., and then distg. at a pressure of 20 mm. A. PAPINEAU-COUTURE

Colored clays of the Olonetz region, U. S. S. R. (LILEEV) 8. Determination of organic peroxides [in oxidized linseed oil] (MARKS, MORRELL) 7. Pigment minerals of South Australia (JACK) 8. Particle size and the properties of matter [in manufacture of pigments] (NEVILLE) 2.

Preparing metal surfaces for painting, etc. CLARENCE F. DINLEY. U. S. 1,729,765, Oct. 1. Surfaces such as those of steel from which rust and oil, etc., are to be removed are sprayed with a compn. including rust solvent acid such as H₃PO₄, a liquid org. oil and grease remover such as alc., and finely divided inorg. solid absorbent material such as fuller's earth and kaolin, together with Fe phosphate, mixed in paste form; the paste is allowed to dry to form a friable coating on the surface, and is removed in dry condition. U. S. 1,729,766 relates to similar compns. contg. powdered absorptive amorphous C. U. S. 1,729,767 also relates to similar compns. for the same purpose. Cf. C. A. 22, 1659.

Pigment. WALTER O. SNELLING. U. S. 1,730,389, Oct. 8. Charcoal is dispersed in water in a colloid mill and the product is treated in a dye bath of complementary color such as a bluish aniline black to form a pigment which may be used as a substitute for usual "carbon black."

Venetian red. OCTAVE VAN CUYCK. U. S. 1,730,178, Oct. 1. A Venetian red compn. suitable for fusion at low temps. on paper or other decorated materials is formed from Fe oxide 10, glycerol 1, flowers of S 4, a resin 10 and niter 4 parts.

Liquid coating composition. GERALD H. MAINS (to Westinghouse Elec. & Mfg. Co.). U. S. 1,730,857, Oct. 8. A compn. suitable for use in making laminated insulating material comprises a condensation product resulting from the reaction of CH₂O, a drying oil such as China wood oil and a coal-tar acid contg. a substantial quantity of xyleneol.

Synthetic resin varnish. GUSTAVE E. LANDT and WM. H. ADAMS, JR. (to Continental-Diamond Fibre Co.). U. S. 1,731,071, Oct. 8. NH₃ and CH₂O are caused to react in an org. solvent such as alc. to form (CH₂)₆N₄ and the initial condensation product of a synthetic resin is dissolved in the soln. to form a potentially reactive varnish. U. S. 1,731,072 specifies dissolving the initial condensation product in an org. solvent such as alc. and then effecting reaction in this soln. between NH₃ and CH₂O.

27—FATS, FATTY OILS, WAXES AND SOAPS

E. SCHERUBEL

The applicabilities of wool fat. R. EHRENSTEIN. *Seifensieder-Ztg.* 56, 297-8 (1929). P. ESCHER

Saponification value of fats with special reference to barley fat. K. TAUFEL AND

M. RUSCH. *Z. Untersuch. Lebensm.* 57, 345-8(1929).—The sapon. value of barley fat increases with increasing time of sapon. and with increasing excess of alkali. Dilm. of the alc. alkali with xylene raises the b. p. of the mixt. but lowers the sapon. value by decreasing the concn. of alkali. The increase in sapon. value is due partly to rosin-like substances, which enter into side reactions, and partly to conversion of unsatd. acids into acids of lower mol. wt. The Reichert-Meissl and Polenske values also increase with increasing time of sapon. C. R. FELLERS

Detection of rancidity of fat from intact seeds and fruits. ANNELIESE NIET-HAMMER. *Z. Untersuch. Lebensm.* 57, 358-60(1929).—Storage affects the fat in seeds. The fat of fresh seeds and fruits gives no Kreis or Fellenberg reaction whereas these reactions are given by the fat of corn, sunflower, flax and other seeds stored for several years and incapable of germination. The disintegrated samples were successively extd. in a linen bag with acetone and CHCl_3 and washed with distd. H_2O and then extd. with petroleum spirit under a reflux condenser. The solvent is distd. from the ext. and the Kreis and Fellenberg tests are applied (C. A. 21, 506). C. R. FELLERS

Quantitative examination of the Kreis rancidity reaction. J. PRITZKER and R. JUNGKUNZ. *Z. Untersuch. Lebensm.* 57, 419-21(1929).—One drop (0.5 mg.) of a fresh aq. 1% soln. of acrolein is mixed with 3 drops of 3% H_2O_2 soln. in a stoppered cylinder, and after 3 hrs. in darkness 5 cc. of concd. HCl (sp. gr. 1.19) is added, and the mixt. shaken for 1 min. After the addn. of 5 cc. of a 1% soln. of phloroglucinol in ether a bright red color is obtained which reaches a max. after 5 min., and, if produced from 0.5 mg. of acrolein, may be matched in shade by 1.2 mg. of KMnO_4 in 100 cc. of water (or 3.8 cc. of 0.01 N soln.). In this version of the Kreis test the acrolein is completely oxidized by the H_2O_2 to epihydrinaldehyde, the sensitiveness of the test being 1:100,000, and the upper detectable limit 10 mg. of aldehyde in 100 cc. of oil. The method has been compared with that of von Fellenberg, and 10-yr. old samples of olive, soy and maize oils, arachis oil (2 yr.), lard (1 yr.) and butter fat (14 yr.) were found to contain 60, 60, 20, 100, 200 and 400 mg. of epihydrinaldehyde per 100 g., resp. Since, in the extreme case, the proportion of decomposed fat corresponds with about 13 times the amt. of aldehyde found, these samples were decomposed to the extent of 0.3 to 5%. C. R. FELLERS

The influence of sulfonation upon the constants of fatty acids. E. GANSEL. *Chem. Umschau Fette, Oele, Wachse Harze* 36, 284 6(1929).—G. treated 19 com. oils with 25% H_2SO_4 in one series and with 30% H_2SO_4 in another, taking care of complete sulfonation and also prevention of desulfonation. To recover the fatty acids, the SO_3 was removed by boiling with 10% HCl , the oils were sapond. and the fatty acids liberated with HCl . The acids had uniformly a different odor than the acids from the original oil; the titer was usually higher especially in those acids contg. unsatd. C bonds, the end point being sometimes indistinct; the I no. had decreased, again more in unsatd. than in satd. acids; the neutralization no. was also lower, in some cases enough to suggest formation of inner esters. The results are tabulated and may serve to det. what type of oil had been sulfonated. P. ESCHER

Fatty acids and glycerides of kusum oil. D. R. DHINGRA, T. P. HILDITCH and J. R. VICKERY. *J. Soc. Chem. Ind.* 48, 281-6T(1929).—Kusum fat from the seeds of *Schleichera trijuga* extd. by ether or CCl_4 contains complex unsaponifiable matter. The compn. of the mixed fatty acids is approx. oleic 60, linoleic 3 to 4, arachidic 20-25, palmitic 5-8, stearic 2-6 and myristic 1%. Arachidic is the main satd. acid present. Lauric acid is not present, contrary to statements of previous investigators. Acetic acid is present to the extent of 1-2% of the crude fat but probably not combined as a glyceride. The general structure of the glycerides appears to be that of other kernel fats, viz., a more or less even distribution of all the acids present among the glycerol mols. Kusum fat yields a soap hard and granular, but of fair lathering power. With oils it could be utilized for soap making. It is uncertain how far the properties of the various non-fatty compds. accompanying the oil would affect its suitability for edible purposes. E. S.

Studies with Twitchell's reagent. I. Influence of salts upon the emulsifying power of commercial fat-splitting agents. KYOSUKE NISHIZAWA. *Chem. Umschau Fette, Oele, Wachse Harze* 36, 277-84(1929).—The emulsifying power of 3 com. Twitchell reagents was measured at room temp. and at 95° in the presence of various substances by counting the drops when the reagent was dropped into purified olive oil from a Donnan pipet (*Z. physik. Chem.* 1899, 42). An addn. of 1% Twitchell reagent is sufficient to characterize its effect; more does not materially increase it. Acids increased the emulsifying power, the more the stronger the acid. The "Pfeilring" reagent was salted out considerably by strong acids; not so the "Idrapid" reagent, while the "Kontakt" reagent was the most sensitive; in all cases where no salting out occurred, the emulsifying power was increased. Addn. of salts of weak acids had little influence upon the emulsifying

power, but strong electrolytes, like NaCl, increased emulsification through increased ion concn. and through a change in the colloidal state; at certain concns. the Twitchell reagent was salted out, and then the emulsifying power decreased. The acidity of "Idrapid" was 241.6, cf "Pfeilring" 237.7 and of "Kontakt" 74.0. The emulsifying power of the Na salt of the reagent is considerable, but 1% of the reagent mixed with 1% of its Na salt has slightly less emulsifying power than 2% of the reagent alone. Addition of glycerol increased the emulsifying power in all cases, likewise the presence of fatty acids, the max. intensity of which is reached at 70% fatty acids. P. ESCHER

Committee on oils, fats and waxes. III. The functions of oils and fats in currying, fat-liquoring, oiling-off and chamoising. D. BURTON AND G. F. ROBERTSHAW. *J. Intern. Soc. Leather Trades Chem.* 13, 383-97(1929).—A survey of the literature. **IV. Iodine values.** V. KUBELKA, J. WAGNER AND S. ZURALEV. *Ibid* 437-42.—The Hanus, Rosenmund-Kuhnenn, and Margosches methods were compared for 6 oils and fats. Good agreement was obtained when the I no. < 100, but considerable variations occurred in the values obtained for a fish oil (125 to 139). The Hanus method is least affected by variations in size of sample, and the Hanus and Rosenmund methods are affected by variations in reaction time. **V. Oils and leather in 1929.** D. BURTON AND G. F. ROBERTSHAW. *Ibid* 522-33(1929).—A survey of the literature. H. B. M.

Results in regrading Lovibond red glasses. IRWIN G. PRIEST. *Oil & Fat Ind.* 6, No. 9, 27-9(1929).—Eight diagrams are given summarizing the results obtained in regrading 1000 red glasses. E. SCHERUBEL

Notes on oil analysis. STANLEY KETTLE. *Chemist-Analyst* 18, No. 5, 7(1929).—A rapid method for getting sapon. values consists in dissolving 5 g. of oil in 15 cc. of benzyl alc., adding phenolphthalein, titrating free acid, adding a measured vol. of KOH in benzyl alc. and titrating the excess after boiling 5 min. under a reflux condenser. Br values can be substituted for I values by dissolving the oil in CCl₄, adding KBr, a little KI and a known amt. of KBrO₃. After shaking, titrate the excess Br with NaHSO₃ soln. The Cl no. is characteristic and can be obtained by treating the sample with a satd. soln. of phenyl iodochloride in CCl₄, finally titrating the excess Cl with AgNO₃. For detg. acid values the substitution of a mixt. of 90% benzene and 10% alc. is better than alc. alone. A useful color test for mineral oils is obtained by short heating with concd. HNO₃. W. T. H.

The test of S. Fachini for the characterization of olive oils. R. MARCILLE. *Ann. chim. anal. chim. appl.* 11, 257-9(1929).—See C. A. 23, 3590. W. T. H.

Chia seed oil. WALTER F. BAUGHMAN AND GEORGE S. JAMIESON. *Oil & Fat Ind.* 6, No. 9, 15-7(1929).—The % compn of this oil is as follows: linolenin 41.1, linolin 47.2, olein 0.7, myristin, satd. acid glycerides + unsaponifiable 0.1, palmitin 5.1, stearin 2.9, arachidin 0.3, unsaponifiable 0.7. The drying power should be equal to or superior to that of linseed oil. The plant grows wild in Mexico. E. SCHERUBEL

The oil of Pistacia lentiscus. F. L. VODRET. *Ann. chim. appl.* 19, 76-84(1929).—This oil is abundant in Sardinia. It is used as a food. It is golden yellow, has aromatic odor and taste, d_{15}^{20} 0.9182, viscosity at 22° 10.65, η_{sp}/c = 1.467, optically inactive, f_D -6.0°, in Wood light shows yellow fluorescence, acid no. 28.05, sapon. no. 209.0, acetyl no. 21.09, acetyl no. after sapon. 228.6, I₂ no. 81.6. The approx. compn. is palmitic acid 24.82, stearic acid 11.63, oleic acid 47.62, linolic acid 6.25, glycerol 9.53, unsaponifiable (phosterol and resins) 0.96%. A. W. CONTIERI

Determining bleaching-loss coefficients. A. S. RICHARDSON, J. T. R. ANDREWS AND R. G. FOLZENLOGEN. *Oil & Fat Ind.* 6, No. 9, 19-20, 43(1929).—Detailed description is given of a lab. method for detg. oil retention by bleaching carths and carbons. The method involves detn. of the increase in wt. resulting when a sample of the bleaching material is treated with oil and the excess oil removed by suction in a stream of hot inert gas under standardized conditions. The oil retention values obtained fall within the range of those observed under practical conditions of plant operation. E. S.

Test for neutral oil in soap or fatty acids. JOHN E. RUTZLER, JR. *Oil & Fat Ind.* 6, No. 9, 23-4, 29(1929).—The test is based on that of Lewkowitsch for unsapond. fat, which specifies that by dissolving 3 cc. of fatty acids in 15 cc. of 95% alc. and adding 15 cc. of NH₄OH a turbidity will appear if unsapond. fat is present. Use is made of an *emulsometer*, consisting of a 100 w. elec. light shielded by a round container with a pin hole in the top and from which a small diam. pipe extends upward. On the top of the pipe a Nessler tube is supported at a distance of 93.2 cm. from the light. The emulsion is poured into the Nessler tube until the light cannot be seen, when the height of the emulsion in the tube is read. The test has been reduced to a quant. basis and the Nessler readings were plotted as ordinates and the % neutral oil as abscissas; and from the Nessler reading by reference to the curve, the % neutral oil can be read directly. E. S.

Soap base and its complete saponification. J. DAVIDSOHN. *Seifensieder-Ztg.* 56, 293-4, 303-5(1929).—The Am. practice of adding coconut oil to the sapon. tallow and continuing sapon. to the end furnishes a soap base of better keeping quality (only 0.1% unsapon. fat is left in the soap) than the German practice of sapon. each oil separately and then mixing the 2 soaps. D.'s method of prepg. cold-made soaps (C. A. 21, 2392) and also the method of sapon. in an autoclave likewise lead to completely sapon. soap bases contg. less than 0.1% unsaponifiable. Soaps with much less than 0.1% may revert, liberating free acids and causing rancidity or brown spots. P. ESCHER

The mean and variability as affected by continuous selection for composition in cotton (WINTER) 11D. The structural viscosity of water solutions of sulfonated oils (SCHINDLER, FLASCHNER) 2. Filter for oil (U. S. pat. 1,730,581) 1.

Extracting fatty acids, resins, bitter substances and mucilage from oils and fats. KARL F. WILHELM. U. S. 1,729,809, Oct. 1. An animal or vegetable oil or fat to be purified is treated with a solvent such as benzine or C_2HCl_3 and the mixt. is subjected to the action of an aq. alc. NH_3 soln.; the product thus formed is further mixed (preferably while warm) with about 1% of Glauber's salt previously dissolved in 10 times its quantity of aq. alc. NH_3 soln.; the products form into layers on standing and are sepd.

Soap for use on the skin. NIELS B. JANSSEN. U. S. 1,730,428, Oct. 8. Soap is produced from a mixt. of tallow 20, lye 10 and celery trimmings 5 parts.

28—SUGAR, STARCH AND GUMS

J. K. DALE

A German sugar factory in the fifteenth century. E. O. V. LIPPMAN. *Centr. Zuckerind.* 37, 872-4(1929). J. F. LEBTE

Sugar technology. W. L. McCLEERY. *Proc. Hawaiian Sugar Planters' Assoc.*, 48th Ann. Meeting 1928, 323-30(1929); cf. C. A. 22, 3796. —Satisfactory operation of the Oliver filter on a com. scale was obtained by increasing the suspended solid matter content of the settled cane juice to 27%. Difficulties were encountered with juices contg. lower percentages of suspended solids. Better performance was also obtained by increasing the spacing of the wires supporting the filter cloth to 2 in. The resistance of metals to corrosion under sugar-factory conditions was in the following order; Delhistandard Fe, Agathan Enduro, Resistal 2600, Alleghany Metal, Tobin bronze, brass, com. bronze, Keystone steel, blue annealed steel, Cu-bearing steel and Toncan. Data are given on the purity-viscosity relations at different densities in molasses from various Hawaiian factories. Expts. on the relation between the dye test for colloids and the filtration rate of raw-sugar solns. showed that the material retarding filtration is of larger than colloidal dimensions. There were indications, however, that a high colloid content is usually associated with a high concn. of the less finely dispersed material that does retard filtration. The thermal value of dry bagasse produced by the Honolulu Plantation Co. varied from 8037 to 8363 B. t. u. per lb. K. D. JACOB

Report of raw-sugar technical committee. W. R. McALLEP. *Proc. Hawaiian Sugar Planters' Assoc.*, 48th Ann. Meeting 1928, 241-7(1929); cf. C. A. 22, 3797. —No correlation was found between the occurrence of hard sugar and the colloid content as detd. by cataphoresis measurements. At relative humidities between 60 and 70%, the moisture in raw sugar comes to an equil. at a point where the sugar is free-running and still has a safe deterioration factor. Within this range hard sugar takes up moisture and softens, while damp sugar dries out, but not to the point where it becomes hard. Upon emptying a warehouse at the end of the season a smaller proportion of sour sugar was found than at the time the sugar was placed in storage. This appeared to be due to the low relative humidity in the warehouse, the sugar drying out until deterioration stopped and the sour-smelling products of deterioration volatilizing. The so-called "dye values" were not reliable indications of the filtration characteristics of raw sugars. Filtration with kieselsol reduced the dye values less than 20%. K. D. JACOB

Denatured raw sugar as fodder. EGON KRAUS. *Z. Zuckerind. czechoslovak. Rep.* 53, 510-2(1929).—See C. A. 23, 4512. J. F. LEBTE

Use of Super-Cel in the sugar-refining industry. ARTHUR ELSENBAST, R. D. ELLIOTT AND E. J. SULLIVAN. *Ind. Eng. Chem.* 21, 676-84(1929).—Super-Cel is the trade name of a patented processed diatomaceous silica. In various sugar-refining

processes, it is decidedly economical to filter the liquors at various stages and reasons for the filtrations specified are outlined. Several flow sheets are shown. W. H. B.

Computations of the yield of sugar. JOSEF HAMOUS. *Listy Cukrovar.* 47, 743-4 (1929).—A series of computations from 4 different refineries. FRANK MARRESH

Studies of sugar-factory filter cloths. III. The changes in the mechanical and physicochemical properties of filter cloths through use. K. ŠANDERA. *Z. Zuckerind. czechoslov. Rep.* 53, 485-92(1929); cf. *C. A.* 23, 2512. J. F. LEETE

Use and control of steam in the sugar industry. J. R. GOODNER. *Power Plant Eng.* 33, 1101-2(1929).—It is important that sugar—possibly from the condensate—be watched for. If present it is apt to decompose, forming acids. The p_H in the boilers is usually kept above 8.0. D. K. FRENCH

The beginnings of the beet-sugar industry in the free state of Saxony. K. ULRICH. *Deut. Zuckerind.* 54, 577-85(1929). J. F. LEETE

Observations on the valuation of sugar beets according to quality. R. E. GROTKASS. *Deut. Zuckerind.* 54, 572-4(1929).—G. points out the unfairness of valuing beets according to weight only. J. F. LEETE

Sugar beets for factory purposes. FRANK T. SHUTT. Canada Dept. Agr., *Rept. Dominion Chemist, Year Ending March 31, 1928*, 34-44(1929).—Tables are given showing the percentage of sugar in juice, coeff. of purity, av. wt. per root and yield per acre of 18 varieties of sugar beets grown in several Canadian provinces. K. D. JACOB

The sugar-beets of Sicily. F. SORGÈS. *Chim. ind. agricolt. biol.* 5, 149-52(1929).—Four varieties of sugar-beets from Sicily, viz. (a) *Blanche française riche*, (b) *Blanche améliorée A*, (c) *Blanche améliorée B*, (d) *Klein Wanzleben*, were examined. The analysis of a, b, c and d gave the following results, resp.: av. wt. kg. 1.098, 1.190, 1.117, 1.258, dry matter 15.4, 18.9, 17.0, 16.9%, sugar 10.55, 14.0, 12.1, 11.9%; ash 1.5, 0.92, 0.86, 0.90%; sucrose in the juice 10.79, 14.85, 12.46, 12.05; Brix 16.3, 18.8, 17.2, 16.6; purity 66.2, 79.0, 72.4, 72.6. G. A. BRAVO

A note on the sampling of sugar beet. S. T. JOHNSON. *J. Agr. Sci.* 19, 311-4 (1929).—Samples of 10 beets do not give even an approx. indication of the true sugar % of a large no. of beets. Increasing the sample to 50 gave a precision that could be considered satisfactory for com. purposes. For exptl. work, however, even 50 beets are inadequate. P. R. DAWSON

The De-Vecchis process for extraction of sugar from beets. IVO GIORDANO. *Giorn. chim. ind. applicata* 11, 155-63(1929). A description of the plant and process developed by De-Vecchis for extrn. of beet sugar. Its feature is that the beets, after washing and slicing, are desiccated, so that subsequent extrn. with hot water gives at once very concd. solns. (about 50° Brix). A. W. CONTIERI

A description of the Scott dryer [for sugar beets] in Sanguinetto, Italy. W. GRAZIANSKY. *Deut. Zuckerind.* 54, 703-4(1929). J. F. LEETE

The composition of the [sugar beet] juices in the 1928-9 season. J. VONDRAK AND B. ZIMMERMAN. *Z. Zuckerind. czechoslov. Rep.* 53, 513-9(1929).—See *C. A.* 23, 3121-2. J. F. LEETE

The purification of raw [beet sugar] liquor. E. TROJE. *Deut. Zuckerind.* 54, 558-66(1929).—A discussion with many references. J. F. LEETE

Experiments in the evaporation of [beet sugar] liquors in the presence of activated carbon. VL. STANĚK AND P. PAVLAS. *Z. Zuckerind. czechoslov. Rep.* 53, 494-9 (1929).—See *C. A.* 23, 3122. J. F. LEETE

A simple apparatus for the determination of color in [beet sugar] juices. A. H. ERDENBRECHER. *Deut. Zuckerind.* 54, 749-51, 825(1929). A color standard is prepared by autoclaving alk. molasses (patent applied for) and used in a special colorimeter to "titrate" distd. water to the color of the liquor. J. F. LEETE

The effects of sugar-beet diseases on the color of the liquors. H. ROESNER. *Centr. Zuckerind.* 37, 802-3(1929).—Exptl. data are given. J. F. LEETE

International society of sugar-cane technologists. Special committee on uniformity in reporting factory data. Fourth communication. M. A. DEL VALLE, E. C. VON PRITZELWITZ VAN DER HORST AND F. W. ZERBAN. *Planter* 83, 141-3(1929).—This report gives: (1) General definitions of sugar house terms and (2) terms and definitions for the milling plant including wt. of bagasse, juice figures, imbibition and diln. figures, cane figures and figures used for judging mill results. J. F. BREWSTER

The effect of diseased cane on the Java ratio. HILARION G. HENARES AND CATALINO G. AURELIO. *Sugar News* 10, 328-33(1929).—The crusher juice from the diseased cane gives high polarization and purity, but since the center of the cane hardly contains any sucrose, because of the effect of the disease, the Java ratio becomes low. V. G. L.

Deterioration in P. O. J. canes. G. B. SARTORIS. *Sugar* 31, 144-6, 196-7 (1929).—Comparative analytical data are given showing changes in sucrose content, purity and acidity of cane varieties P. O. J. 36, 213, 234 and 826 in Louisiana when left standing or when windrowed in winter. In warm weather spontaneous inversion in cut cane is rapid, but very slow after a frost. It is considered better to let cane stand in the field until it can be cut for the mill rather than to windrow it.

J. F. BREWSTER

Laboratory control of processes. RUDOLF FREUND. *Listy Cukrovar.* 47, 721-6 (1929).—F. reviews all of the possible methods which labs. can use in controlling the process by which sugar is made. A complete bibliography is given.

FRANK MARESH

Laboratory studies of the effect of carbon monoxide and other components of saturation gas (CO₂) on the rate and course of the saturation. R. SIGMUND. *Z. Zuckerind. czechoslovak. Rep.* 53, 473-9 (1929).—See *C. A.* 23, 2317.

J. F. LEEBE

Experiments in the saturation of thin liquors. L. KAYSER AND P. WENDELER. *Deut. Zuckerind.* 54, 553-6 (1929).—The curves show that treatment with SO₂ alone produces a marked decolorization only from p_H 8 to 7, the optimal lime removal lying in this region also. Treatment was carried out with SO₂ (1), CaO (2) and CO₂ (3) in the orders 3, 2, 3; 1, 2, 1; 1, 2, 3. The CO₂ treatment was always carried to optimal alky. CaO was 0.2 or 0.07%, SO₂ to p_H 7 or less. The results all show that the lime removal varies with the residual alkalinity. The best lime removal as well as that the highest purity of liquor is attained by the CO₂, CaO (0.2%), CO₂ treatment, but the decolorization is only 10%. These methods will be tested in the refinery.

J. F. LEEBE

Determining the sugar content of saturation sediments. J. KADLEC. *Listy cukrovar.* 47, 735-6 (1929).—Samples of sediment from about 30 places in the sediment presses were collected before the sugar soln. was expressed; the samples were mixed together and analyzed for sugar by the Zn(NO₃)₂ method. The expressed juice was analyzed by polarization. The sediment contained 11.13% sugar; the expressed juices 25.5%, and the expressed sediment 1.4%. No explanation is given for this anomaly. For HERLES. *Ibid* 748—A criticism of the work of Kadlec. JOSEF HAMOUS. *Ibid* 748-9—A discussion of all possible errors in the analytical procedure of the above analysis by Kadlec.

FRANK MARESH

The distribution of sampling vessels for raw juices and molasses. FERDINAND KAYZ. *Listy Cukrovar.* 48, 14-5 (1929).—A modification in design is described.

FRANK MARESH

Centrifugal clarification. R. H. HURST. *Trop. Agr. (Trinidad)* 6, 112-3 (1929).—Expts. were conducted on clarifying sirup and molasses by centrifuging at 3000 and 2,000 r. p. m. Centrifuging reduced the viscosity of the samples. Pectins are easily removed by centrifuging but pentosans are not. Pectins are therefore thought to be less highly hydrated in soln. The sludge removed by centrifuging contained about 50% ash. The results indicate that centrifuges may be successfully used for sugar clarification on a factory scale.

A. L. MEHRING

An efficient sugar-concentration apparatus. C. W. EDDY AND PAUL SCHILDNECK. *Chemist Analyst* 18, No. 5, 15 (1929).—By means of an adapter tube, such as is used with condensers, and glass tubing, a simple vacuum separatory app. can be constructed which is useful for removing liquid from a strongly foaming soln. such as obtained in the extn. of certain aldehyde sugars by vacuum distn.

W. T. H.

A steam balance in evaporation and vacuum pans. JOS. HAMOUS. *Listy Cukrovar.* 48, 7-8 (1929).—A series of computations is given.

FRANK MARESH

Extraction of last liquors. JIRÍ DIEHN. *Listy Cukrovar.* 47, 749 (1929).—An ext. having a sp. gr. below 1.08 and 48° of hardness was evapd. on a H₂O bath yielding a brown liquid (sp. gr. 1.75) with an invert-sugar content 1.10 per 100 g. of dry matter and a purity of 94.0. An ext. of the same batch was passed through a H₂O softener and showed 6° of hardness. This soln. was concd. to a sp. gr. = 1.63; it had a pale yellow color, a purity of 96.0 and 0.36 parts of invert sugar per 100 parts of dry matter. Further studies are promised.

FRANK MARESH

Weights per U. S. gallon and weights per cubic foot of sugar solutions. C. F. SNADPR AND L. D. HAMMOND. *Planter* 82, 501-2 (1929).—Four tables are computed for use in sugar work. Table 1 gives wts. per U. S. gal. and wts. per cu. ft. of sugar (sucrose) solns. at 20°. Table 2 gives wts. per U. S. gal. of sugar (sucrose) solns. at different temps. Table 3 gives wt. in air of a 70% soln. of sucrose at 20° at different barometric pressures. Table 4 gives a condensed table comparing the table at 17.5° of Spencer's Handbook with Table 1.

J. F. BREWSTER

The reducing power of sucrose. G. BRUNNS. *Centr. Zuckerind.* 37, 852-4, 874-5 (1929). A review with references. Ten g. sucrose is equiv. to 28.16 (av.) mg. Cu. B. points out the likelihood of Na saccharate formation.

J. F. LEEBE

Color perception of workers in sugar or chemical laboratories. R. H. KING AND G. A. GUANZON. *Planter* 83, 222-3(1929).—Students were differentiated into 2 groups: (a) Color-blind, those who could not match colors or observe color changes and (b) color-ignorant, those unable to sep. colored strips according to designated terms. It was shown that about 3% of the workers in routine work are color-blind and about 10% of individuals may be expected to be color-blind or color-ignorant. The results given will aid in detg. the accuracy of individual workers and will provide a simple method of evaluating workers assigned to colorimetric work. J. F. BREWSTER

The diffusion of non-sugars. VL. STANEK AND J. VONDRÁK. *Listy Cukrovar.* 47, 745-8(1929).—Four solns. were used: (1) a 0.1% NaCl, (2) a 0.1% urea, (3) a mixt. 0.5 NaCl and 0.5% urea, (4) 0.5% urea for studying the reaction rate. The quantity of non-sugars which diffused from the solns. into the diffusion liquor was (1) 39%, (2) 27%, (3) 26%, resp. In the 4th soln. a rapid withdrawal and a slow operation caused a transfer of 26% of the urea; a rapid operation caused a transfer of 30% of the urea. A slow rate of withdrawal yielded a better liquor; only 19% of the urea diffusing over. A rule is formulated: withdraw the liquor as slowly as possible without causing infection when using contaminated or hard water. The impurities in water penetrate into the cells of the beets and thus effect a cleansing action of the diffusion liquor. An alk. water contg. 0.1% carbonaceous ash would diffuse approx. 0.03% ash into the diffusion liquor and increase the ash of the liquor 0.025 ± 0.005 %. Since 1 part of ash retards 5 parts of sugar from crystallizing and gives origin to 10 parts of molasses, the probable increase in molasses will be 0.25%. The org. non-sugars in a 0.1% concn. would diffuse to form a 0.03% concn. in the diffusion liquor; the increase in molasses due to the org. non-sugars would be 0.125%. Even though many of these products may be removed in satn., the losses in quality and quantity are large. FRANK MARESH

Experiments in the rapid cooling of low-grade massecuites. ARNOLD H. WARREN. *Sugar News* 10, 317-23(1929).—W. shows (1) that a low-grade massecuite can be cooled rapidly without formation of false grain; (2) that molasses of below 33 apparent purity can be obtained within 10-12 hrs. after the cooling is begun and (3) that any low-grade massecuite purges much more rapidly when hot than when cold. V. G. LAVA

Old and new methods of treating sugar-factory waste waters. J. JASKÓLSKI. *Z. Zuckerind. czechoslovak. Rep.* 53, 503-10, 519-24(1929). A discussion. J. F. LEETE

The treatment of waste waters from sugar-refineries. JOSEF JASKÓLSKI. *Listy Cukrovar.* 48, 1-7, 9-14(1929).—(I) Several processes are reviewed. (II) Cl was passed into an absorption tower into which the waste water was sprayed. The Cl functioned as a sterilizing and deodorizing agent. The presence of Cl in the return H₂O aids in sedimentation; an absence of humin material and 55% of the usual lime addn. gave good sedimentations. This is due to the fact that the Cl prevents fermentation, during fermentation, protective colloids form and prevent a flocculation and sedimentation of org. matter. The optimum results were given when the p_H exceeded 9. FRANK MARESH

The adsorption properties of active, ash-free char preparations. ERHARD LANDT AND K. K. BHARGAVA. *Z. Ver. deut. Zuckerind.* 79, 470-84(1929). Inactive sugar chars activated in various ways (preferably by air at 550-1050°), show an iodine-adsorption power comparable to that of commercial chars. Their behavior toward HCl and NaOH varies considerably with the method of prepn. With fatty acids they behave more uniformly, the amt. of the acid adsorbed increasing directly with the number of C atoms in the acid. These chars are of little value in removing the coloring matter of molasses, the dimensions of the pores being too small. The lower the temp. employed and the smaller the amt. of air used for activation, the higher is the adsorptive power of the char for NaOH. The greater the alkali-adsorptive power of the sugar char, the smaller is the increase in adsorbability for fatty acids as the fatty acid series is ascended. A review of the literature is given and the results are discussed. F. CAMPS-CAMPINS

The character of active carbons. P. TERECHOV AND J. DĚDEK. *Sugar* 30, 349-50, 395-6, 443-4(1928).—I. Cataphoresis expts. with 2 carbons, A, a low temperature C, and B, a high temperature C, suspended in 60% sugar solns. Both kinds of particles move to the anode, A more rapidly than B. II. Sedimentation expts. Both types are more stable in alk. solns. A settles more quickly in acid soln. and B more quickly in pure H₂O. III. Conductivity measurements upon suspensions of the carbons in H₂O and in solns. of electrolytes are given. J. F. BREWSTER

Studies on tapioca. III. Further notes on the determination of phosphoric acid in tapioca material by the ceruleo-molybdate method. V. R. GREENSTREET. *Malayan Agr. J.* 17, 210-2(1929); cf. C. A. 22, 3602.—A comparison of phosphoric acid detns. by the ceruleo-molybdate and molybdate-magnesia methods. There is no relationship

between the acidity of the solns. examd. and the error in the detn. of phosphoric acid. Out of 33 samples, in 13 instances the colorimetric result was lower than the gravimetric, in 12 instances it was higher, while in 8 instances the results were identical. In only 8 instances did the discrepancy amount to more than 10%.
E. F. SNYDER

Megass. Its value as a material for the manufacture of paper and of artificial silk (ANON.) 23. Report on agriculture (VERRET, MANGELSDORF) 15. Factors influencing the growth and sugar content of cane (RAO) 11D. What quantity of fertilizer to use (LOCSIN) 15. H_2PO_4 gives big increased yields in uplands of La Carlota district (ANON.) 15. Abo-abo soils respond to potash (ANON.) 15. The viscosity of viscous liquids [sugar solutions] (VOLAROVICH) 2. Investigation of viscous liquid [sugar solutions] (DERIAGIN, KHANANOV) 2. Secondary products in the extraction of glutamine from beets (RAVENNA, NUCCORINI) 11D.

Recovering sucrose from cane molasses. HOLGER DE F. OLIVARIUS (to Calif. Packing Corp.). U. S. 1,730,473, Oct. 8. The molasses is fermented to eliminate invert sugar, the fermented molasses is mixed with alc., an earthy metal oxide or hydroxide is added to the soln. to ppt. interfering org. and coloring matter without materially pptg. the sucrose, the ppt. is sepd. and the alc. is sepd. from the remaining soln. and the latter is then treated with an earthy mineral oxide or hydroxide to ppt. the sucrose.

29—LEATHER AND GLUE

ALLEN ROGERS

Report of the Committee of the International Society of Leather Trades Chemists on Tannin Analysis. J. GORDON PARKER, *et al.* *J. Intern. Soc. Leather Trades Chem.* 13, 112 21(1929). Comparative analyses of different tanning materials indicate that the Procter extractor gives results for sol. matter practically identical with those yielded by the Koch extractor. The use of 2000 ml. H_2O and an extn. period of 4 hrs. is advised. The official restoration of the Procter app. is advocated on account of its simplicity and ease of operation. Comparative detns. of H_2O by the direct and by the indirect methods, using vacuum oven, elec. oven, H_2O oven and "combined evaporator-drier," resulted in higher figures by the direct method, no matter which form of drying app. was used. It is advised that the direct method for H_2O be made compulsory for all solid exts. Comparison of results obtained for sol. matter using (1) the filter candle, (2) 5 different papers and 2 different kaolins, (3) Turnbull's method, (4) McCandlish-Atkin method, (5) centrifuge and (6) sedimentation showed that (2) gives slightly lower results than (1); (1), (3) and (4) give practically identical results; (5) and (6) give decidedly higher results than (1). By increasing the pretannage of the paper, the results obtained by (2) approach those obtained by (1). (1), (2), (3) and (4) give equally concordant results in the hands of different analysts. The filter candle method is preferred as being quicker and simpler than the so-called contact method. The official method of chroming hide powder is considered preferable to the former method. H. B. MERRILL

The modified agitation method for tannin analysis and the Darmstadt apparatus. G. BALDRACCO. *J. Intern. Soc. Leather Trade Chem.* 13, 365-75(1929); cf. *C. A.* 19, 3170, 23, 1768, 3592.—The method is the most practical, rapid and rigorously scientific of all methods yet known, and is at least as exact as the official method. H. B. M.

Tannin content of dead chestnut trees. R. M. NELSON and G. F. GRAVATT. *J. Am. Leather Chem. Assoc.* 24, 479-499(1929).—Chestnut trees dead up to 30 yrs. contained as much tannin as av. living trees. Decayed wood contained practically as much tannin as sound. The bark and heartwood of chestnut contained 7-12% tannin (A. L. C. A. method), and the sapwood 2-4%. H. B. MERRILL

Tanniferous barks of Madagascar. IV. "Sakoa" bark (*Sclerocarya caffra* Sond). A. DEFORGE, J. MAHEU and F. HEIM DE BALSAC. *Halle aux Cuirs* 1929, 238-41; cf. *C. A.* 23, 4366.—The tannin content (about 3.5%) is too low to warrant exploitation. "Lalona" bark (*Weinmannia* Sp.) *Ibid* 278 86.—Analysis showed H_2O 11.3, sol. tannin 13.7, sol. non-tannin 2.7, insol. matter 72.3%. Catechol tannin predominates. Leather tanned with sakao is satisfactory except for the color, which is too yellow. The bark has local possibilities, but is hardly valuable enough for exportation. H. B. MERRILL

Some south-Japanese tanning materials. G. GRASSER. *Cuir tech.* 18, 225-30 (1929).—See *C. A.* 23, 3593. J. G. NIERDERCORN

The practical tanner and physical chemistry. A. A. CLAFLIN. *Leather Manufacturer* 40, 64-6(1929).—A discussion of the phys. chemistry of tanning. H. B. M.

Contributions from the institute of tannery science. IV. G. GRASSER AND H. NAKANISHI. *Cuir tech.* 18, 270-3, et seq.(1929).—See C. A. 23, 4365. J. G. N.

Improved tannage for book-binding leather. J. R. LORENZ. *Hide & Leather* 78, No. 2, 23-5(1929).—Leather tanned first with chestnut and dividivi, followed by sulfited quebracho, is claimed to equal that produced by the customary sumac tannage.

Purification of tannery effluents by colloidal clay. J. BESSE. *J. Intern. Soc. Leather Trades Chem.* 13, 503-7(1929); cf. following abstr.—By acidifying with H_2SO_4 and treating with a suspension of clay, practically all impurities are pptd., and the effluent is rendered clear, free from sulfide, low in N and non-foaming. H. B. M.

The purification of tannery effluents by means of argillaceous colloids. J. BESSE. *Cuir tech.* 18, 244-6(1929); cf. preceding abstr.—Lime liquors were made slightly acid to phenolphthalein and an equal vol of 2% brick clay suspension, prep'd. by agitating clay in 0.05% Na_2CO_3 , was added. Analyses of 4 lime liquors showed that in all cases the total N, sulfides, and solids of the solns. after flocculation were 10% or less of the original concentrations. The great disadvantage is the large vol. of H_2O necessary. *Ibid* 294-7.—A review of the colloidal properties of clays.

The unhairing and tanning of sheepskins. ALBERT J. HANGLIN. *Cuir tech.* 18, 324-5(1929).—A description of American methods. J. G. NIEDERCORN

Tanning of sheepskins with the wool. O. DUJARDIN. *Leather Manufacturer* 40, 123-4(1929).—Descriptive. H. B. MERRILL

The question of lactic acid bacteria in tanning liquors. R. W. SCHWARTZBERG AND P. M. GINDIS. *Zentr. Bakt. Parasitenk., Abt. 2*, 78, 96-105(1929). J. T. M.

Sulfur dioxide in tanning. SHAPERO AND LESZINSKII. *Vestnik Koshevennoi Prom. i Torgovli* 1927, 283.—Soaking in 1% SO_2 soln. gives favorable results. Deliming with SO_2 is cheaper than with ordinary mineral acids and gives better results. The following formula is recommended for sulfiting or ordinary quebracho. Per 100 kg of quebracho, 1 kg. of SO_2 is used and 2.4 kg. soda ash or 2 kg. of NaOH. The quebracho is heated with water, the SO_2 is introduced from a cylinder and the soln. is neutralized for reduction of $\text{Na}_2\text{Cr}_2\text{O}_7$ in the prepn. of 1-bath and also of 2-bath chrome liquors. The use of SO_2 in the prepn. of chrome tanning liquors is advantageous because of the elimination of Fe and of the excess of Na_2SO_4 , which is not always a desirable ingredient for tanning liquors. B. MONSAROFF

Useful notes on chrome tanning. LIBOSLAW MASNER. *Cuir tech.* 18, 203-4(1929).—Methods of liming and tanning calf-skins and sides are described. J. G. N.

The preparation of chrome tanning liquors. B. KÖHLER. *Gerber* 55, 167-8(1929).—The use of $\text{Na}_2\text{S}_2\text{O}_4$ in the reduction of $\text{K}_2\text{Cr}_2\text{O}_7$ in the presence of Cr alum is to be preferred to the use of $\text{Na}_2\text{S}_2\text{O}_3$ and Cr alum only, because long boiling is unnecessary and the colloidal S is left in the most desirable condition. For the prepn. of the equiv. of 100 parts by wt. of Cr alum, the following formula has been developed: $100-0.75B$ wt. of Cr alum; $0.2206B$ = wt. of $\text{K}_2\text{Cr}_2\text{O}_7$ and $0.5586B$ = wt. of $\text{Na}_2\text{S}_2\text{O}_4$, where B is the basicity (Schorlemmer). J. G. NIEDERCORN

Waste products of the saccharin industry used in synthesizing tanning agents and in tanning. WALTHER HERZOG. *Metallbörse* 19, 1853-4(1929).—The utilization of *p*-toluenesulfonyl chloride, and *p*-toluenesulfonic acid in the tanning industry is shown chiefly from patent references quoted. W. C. EBAUGH

Nomographic chart for the determination of non-tannins. D. S. DAVIS. *Chemist Analyst* 18, No. 4, 8(1929). W. T. H.

Chrome leather spew and its qualitative analysis. G. GRASSER. *Cuir tech.* 18, 204-5(1929); cf. C. A. 23, 3594.—A brief review of previous work with references is given. For analysis spewed areas are scraped with a spatula and a sample so collected is burned upon a loop of Pt wire in a Bunsen flame. The odor of acrolein and a bright flame indicate fatty acids; the odor of SO_2 and a blue flame indicate S. If fusion takes place and an ash remains, a salt is present and tests for Ba, Al, Na, K, Ca, Cl and SO_4 are made. The spew may be extd. with petroleic ether and a drop of the ext. placed on sized paper; a visible grease spot results if fatty acids are present. The spew may also be warmed with a few drops of 20% NaOH soln. and then Na nitroprusside soln. added; a violet coloration indicates the presence of S. J. G. NIEDERCORN

The natural fats of goat skins and their relation to the formation of fatty spews in chrome leather. R. FARADAY INNES. *J. Intern. Soc. Leather Trades Chem.* 13, 375-82(1929).—In many skins showing fatty spew, the spew is assocd. with a purple compd. of

Cr and fatty acid, sol. in petr. ether. The white spew consists mainly of fatty acids having a m. p. of about 50–51°. On treatment of oleic acid with basic 1-bath Cr-liquor, a purple ppt. is formed that is sol. in petr. ether and contains 2.9–3.6% Cr. A similar compd. is formed by treating Ca oleate with Cr liquor, but is not formed with stearate or palmitate or the free acids. The glycerides give no such compd. The important factor predisposing the finished leather to the formation of spew is the presence of free fatty acids in the fat. These may arise through improper curing or storage conditions, producing rancidity. Variable amts. of lipase were demonstrated in cured goat skin as it reaches the tanner. Pancreatic enzymes used in bating apparently do not exert an appreciable hydrolytic action on the skin fat. The purple spew was produced experimentally by impregnating skins with oleic acid before Cr tannage, and the white spew was produced by introducing stearic and palmitic acids.

H. B. MERRILL

The microscopic structure of some fish skins. MADGE KAYE. *J. Intern. Soc. Leather Trades Chem.* 13, 515–22(1929).—Photomicrographs of the dogfish, ray, cod and ling are given. The skins of elasmobranchic fishes are better suited to leather-making than those of the bony food fishes.

H. B. MERRILL

Examination of raw hide. G. GRASSER. *Cuir tech.* 18, 202–3(1929).—See C. A. 23, 3593.

J. G. NIEDERCORN

Curing and sterilization of hides and skins. D. J. LLOYD. *Hide and Leather* 77, No. 1, 26–8, No. 4, 34–5(1929).—An address.

H. B. MERRILL

Red heat and salt stains (in hides). D. J. LLOYD. *Leather World* 21, 621, 698–9; *Shoe and Leather Reporter* 175, No. 10, 37–8(1929).—"Red heat" stains are due to the growth of red bacteria that thrive best at high salt concns. They are introduced into the hide with salt of marine origin (generally). Similar yellow organisms are known. Growth is retarded by lowering the temp. and by drying, and is inhibited by adding acid or alk. salts to the curing salt.

H. B. MERRILL

The cause of perforations in tawed skins. M. F. MERLIER. *Cuir tech.* 18, 374–7(1929). Perforations are attributed to the neutralization of lactic acid produced in insufficient amounts by the fermentation of bran. All baths should be kept slightly acid or decidedly alk. to inhibit the growth of harmful bacteria.

J. G. NIEDERCORN

Pancreatic enzymes in bates. LEOPOLD POLLAK. *Gerber* 55, 164–6(1929).—A review.

J. G. NIEDERCORN

The newer chemicals. A. A. CLAFLIN. *Leather Manufacturer* 40, 232–3, et seq. (1929).—A discussion of the newly commercialized aliphatic compds. of possible use in the leather industry.

H. B. MERRILL

Leather manufacture. M. C. LAMB. *Hide and Leather* 77, No. 11, 24–5, No. 12, 21–5, *Shoe and Leather Reporter* 173, No. 12, 28–32, et seq. (1929).—Descriptive.

H. B. MERRILL

Leather manufacture. C. S. RICE. *Leather Manufacturer* 40, 67, et seq. (1929).—The first of a series of articles on the manuf. of different kinds of leather.

H. B. M. MERRILL

Wet work in light leather manufacture. D. McCANDLISH. *Leather World* 21, 274–6(1929).—A discussion.

H. B. MERRILL

Cellulose finishes for leather. FINI G. A. ENNA. *Hide and Leather* 78, No. 6, 26–9(1929).—A discussion.

H. B. MERRILL

Measurement of the properties of sole leather. D. BURTON. *Hide and Leather* 78, No. 4, 32–3, No. 5, 24(1929); cf. C. A. 23, 4367.—A review.

H. B. MERRILL

Vegetable-tanned sole leathers. A. COLIN-RUSS. *J. Intern. Soc. Leather Trades Chem.* 13, 443–62(1929); cf. C. A. 22, 329.—From analyses of numerous leathers it is deduced that the following relationship exists between quality and (1) % collagen and (2) ratio collagen: H_2O -sol. matter: Grade I: collagen > 42%, (H_2O -sol. collagen) < 0.4; Grade II: collagen = 42–32%, (H_2O -sol. collagen) = 0.4–0.9; Grade III: collagen < 32%, (H_2O -sol. collagen) > 0.9. In general, % fat, H_2O , ash and degree of tannage increase from Grade I to III, while % (collagen + fixed tannin) decreases from Grade I to III. No progression was noted in (free tannin/ H_2O -sol. matter). Liability to spew is a function of structure rather than compn. The grade may readily be deduced for microstructure (illustrated).

H. B. MERRILL

Analysis of vegetable-tanned leather. Committee Report. P. CHAMBARD, et al. *J. Intern. Soc. Leather Trades Chem.* 13, 355–65(1929).—The text of proposed official methods is given.

H. B. MERRILL

Fast colors on leathers. M. C. LAMB. *Leather World* 21, 448–50, 528–30; *Cuir tech.* 18, 318–20, et seq. (1929).—See C. A. 23, 5348.

H. B. MERRILL

committee on oils, fats and waxes (BURTON, et al.) 27.

Dye composition for leather. BENJAMIN R. HARRIS. U. S. 1,729,938, Oct. 1. A dye such as Nigrosine is dissolved in a mixt. of alc. with an aromatic hydroxy compd. such as cresol.

30—RUBBER AND ALLIED SUBSTANCES

C. C. DAVIS

Studies on the hydrogen-ion concentration by coagulating latex of Hevea brasiliensis. I. Sodium fluosilicate as coagulating agent. L. R. VAN DILLEN. *Arch. Rubber-cultuur* 13, 448-64(1929). (In briefer form in English 465 72.)—The beginning of a study of the p_H concn at which latex coagulates, the present paper deals with the theory of the quinhydrone electrode and the system used in the exptl work undertaken. The assumption of van Harpen regarding the splitting of Na_2SiF_6 is discussed critically and is considered to be erroneous. An alternate theory is offered in its place. Na_2SiF_6 soln. acts as a buffer, the components being 1 part of NaF and 2 parts of HF. The p_H values of the Na_2SiF_6 solns. are higher than the theoretical values of the corresponding buffer mixts., but NaF and HF in Na_2SiF_6 solns. are available in very low concns. By dilg. a buffer consisting of 1 equiv. of NaF and 2 equivs. of HF, the p_H value is the same as in Na_2SiF_6 soln. By dilg. a Na_2SiF_6 soln. the p_H value diminishes at first and subsequently increases gradually. This may be explained on the assumption that the degree of hydrolysis increases more rapidly than the degree of diln. At the lowest p_H value the remaining fluosilicate is entirely split up, after which by carrying on to a greater diln. the concn. of NaF and of HF diminish, and this involves a gradual increase of the p_H . Tests with very weak mixts. of latex and Na_2SiF_6 solns. showed that in this way the p_H values diminished greatly, chiefly as a result of the remaining fluosilicate splitting up entirely though there are probably other phenomena contributing to this result. Moreover, by dilg. with water samples of latex of different origins, great differences in the p_H range were found, because of the fact that the water samples were buffered in a different way. Measurements of the p_H values in buffers consisting of NaF and HF proved the assumption that in Na_2SiF_6 solns. 1 mol. of Na_2SiF_6 yields 1 mol. of NaF and 2 mols. of HF.

C. C. DAVIS

Uses of rubber latex. JOSEPH ROSSMAN. *India Rubber World* 81, No. 1, 63 6 (1929).—A survey of U. S. patents dealing with the direct applications of latex in industry.

C. C. DAVIS

Observations on the chemical constitution and physical properties of rubber. LOTHAR HOCK AND GUIDO FROMANDI. *Rubber Chemistry and Technology* 2, 365 6 (1929).—English version of C. A. 23, 3371.

C. C. DAVIS

The "freezing" of raw rubber. A. VAN ROSSEM AND J. LOTJICHUS. *Rubber Chemistry and Technology* 2, 378-83(1929). English version of C. A. 23, 2829.

C. C. DAVIS

Determination of the iodine number of raw rubber. ADOLF GORGAS. *Pubber Chemistry and Technology* 2, 362-4(1929).—English version of C. A. 23, 1525.

C. C. DAVIS

Rubber compounding practice. Ingredients for economy, processing and inflation. WEBSTER NORRIS. *India Rubber World* 81, No. 1, 53 6(1929); cf. C. A. 22, 2489. The discussion includes barytes, whiting, dusting powders, kerosene and sponging agents.

C. C. DAVIS

Toxic substances in the rubber industry. I. Benzene. P. A. DAVIS. *Rubber Age* (N. Y.) 25, 367-8(1929).—The results of an examn. of 7000 patients during 12 yr are described. **II. Carbon tetrachloride.** *Ibid* 483 4. **III. Aniline.** *Ibid* 611 2.

C. C. DAVIS

The recovery of volatile solvents in the rubber industry. ANON. *India Rubber World* 81, No. 1, 57(1929).—An illustrated description of the "Acticarbone" process.

C. C. DAVIS

The purification and fractionation of rubber. VII. RUDOLF PUMMERER, ALBRECHT ANDRIESEN AND WOLFGANG GÜNDEL. *Rubber Chemistry and Technology* 2, 367-72(1929).—English version of C. A. 22, 4873.

C. C. DAVIS

The absorption of oxygen by rubber. G. T. KOHMAN. *Rubber Chemistry and Technology* 2, 390-405(1929).—See C. A. 23, 2600.

C. C. DAVIS

The tackiness of unvulcanized rubber. T. L. GARNER. *Rubber Chemistry and Technology* 2, 384-9(1929).—See C. A. 23, 3373.

C. C. DAVIS

The preparation and molecular size of isorubber nitrene. VIII. RUDOLF PUM-

MERER AND WOLFGANG GÜNDEL. *Rubber Chemistry and Technology* 2, 373-7 (1929).—English version of C. A. 22, 4874. C. C. DAVIS

Transformation of energy by rubber. IRA WILLIAMS. *Ind. Eng. Chem.* 21, 872-6 (1929).—The exptl. data indicate that elasticity is a property which persists through vulcanization and is not created by the latter process. The phys. state of the rubber after any cure depends upon the balance between suppression of plasticity (caused directly or indirectly by the reaction with S) and the creation of plasticity by heat. Moreover S probably combines at a slower rate with the elastic component so that a product with almost no mech. strength is finally formed. The transformation of energy by rubber depends upon the condition of the rubber as well as the conditions of the test. Heat liberated by elastic strain can be transformed almost quantitatively into mech. work. Heat arising from internal frictional resistance caused both by plastic and by elastic flow is irreversible. Any reduction in time of transfer of energy reduces the quantity lost through plastic flow, while an increase of temp. increases the resistance of the elastic component to strain, but also reduces the resistance of the plastic component to flow. With sufficient increase of temp., there is a large loss of energy because of a considerable though limited permanent flow of the rubber. This cannot be plastic flow of the elastic component since it is limited in magnitude, and it can be explained by a mech. change, e. g., a breaking of the anchorage between the plastic substance and the elastic network. C. C. DAVIS

Accuracy of rubber stress-strain determinations. W. H. STEVENS. *India Rubber J.* 78, 380 (1929).—A comparison of the frequency distribution of tensile strength values obtained by Wiegand and Braendle (C. A. 23, 4372) with those of de Vries (cf. *Estate Rubber*, 166; C. A. 15, 2563) shows a resemblance between the 2 sets of data, including a similar neg. skew. The conditions of testing were different in the 2 cases, so that it is difficult to judge the significance of this similarity. C. C. DAVIS

The double refraction of stretched rubber. W. C. VAN GEEL AND J. G. EYMERS. *Rubber Age* (N. Y.) 25, 491-3 (1929).—English version of C. A. 23, 4099. C. C. DAVIS

The relationship between forces and deformations, with special reference to rubber. R. ARIANO. *India Rubber J.* 78, 316-8 (1929).—English version of C. A. 23, 545. C. C. DAVIS

Pigment reinforcement. R. W. LUNN. *Rubber Chemistry and Technology* 2, 331-20 (1929).—See C. A. 23, 3371. C. C. DAVIS

Comparison between Vulkan DK Red and Selenium Red. R. DITMAR AND K. H. FRIESEN. *Caoutchouc & gutta-percha* 26, 14686 (1929).—Selenium Red (I) is stable with all com. accelerators, whereas Vulkan DK Red (II) gives attractive red colors only with Zn ethylphenyldithiocarbamate, cyclohexylamine dithiocarbamate, mercaptobenzothiazole and thiocarbamilide. I is stable with soap or with EtOH, whereas II is not. In general I can be used for a much greater variety of purposes than can II. C. C. D.

Why not have more sponge rubber products? R. R. OLIN. *Rubber Age* (N. Y.) 25, 663-4, 673 (1929).—An illustrated description showing the present status of the sponge rubber industry and its future possibilities. C. C. DAVIS

Spray sulfur for rubber tree protection. VINCENT SAUCHELLI. *India Rubber World* 81, No. 1, 65 (1929).—A com. type of S is described which has a particle size of 1-5 μ , and which is extremely effective for combating fungous diseases when used in the regular manner. It should also be of value in vulcanizing latex. C. C. DAVIS

The reclaimed rubber industry in the United States today. ANON. *Rubber Age* (N. Y.) 25, 574-8 (1929).—Numerous illustrations of plants are included. C. C. D.

An enquiry into the use of reclaimed rubber. J. PANEM. *Déchets et régénérés* 1, No. 2, 2 (1929), cf. Hutchinson, C. A. 23, 4373.—Satisfactory results in manuf. can be obtained with reclaimed rubbers only by the use of types which are uniform and which show good aging properties. C. C. DAVIS

The history and trends in the use of reclaimed and scrap rubber. H. A. WINKELMAN. *Rubber Age* (N. Y.) 25, 544-7, 561 (1929).—Descriptive. C. C. DAVIS

The rational use of scrap and reclaimed rubber. H. BAUFARON. *Rev. gén. caoutchouc* 6, No. 54, 13 (1929).—Typical formulas contg. large proportions of scrap or reclaimed rubber for various uses are given. C. C. DAVIS

Classification of reclaimed rubbers. W. R. GLANCY. *Rubber Age* (N. Y.) 25, 560 (1929).—The different types of reclaimed rubber now in use are distinguished, with accompanying data showing the usual limits of acetone ext., CHCl_3 ext., ash, d. and tensile strength (no formula or conditions are given) of tire, tire friction, solid tire, inner tube and boot and shoe reclaimed rubbers. C. C. DAVIS

Reminiscences of an old timer in the reclaimed industry. L. J. PLUMB. *Rubber*

Age (N. Y.) 25, 552-3, 562(1929).—A general description, showing the chem. and tech. nical developments which have taken place. C. C. DAVIS

Effect of milling on the plasticity of reclaimed rubber. D. P. SWISHER AND P. W. SANDERS. *Rubber Age* (N. Y.) 25, 559-60(1929).—An exptl. comparison was made between the plasticizing effect of milling for various lengths of time on (1) tire reclaim alone; (2) a mixt. (50:50) of reclaim and pale crepe and (3) pale crepe alone. Plasticity measurements were made, after cooling 3 hrs., with the Williams app. at 70°. The results are given graphically and in tables. Milling had less effect on the plasticity of reclaimed rubber than it did on raw rubber, and yet a mixt. of raw and reclaimed rubber was more easily plasticized on milling than was raw rubber alone, confirming previous observations that reclaimed rubber aids in the plasticizing of new rubber. After reclaimed rubber formed a solid sheet on the mill, little further diminution in plasticity took place, the only effect of continued milling being to increase the stickiness decidedly. This latter effect makes the use of reclaimed rubber particularly advantageous in frictioning mixts. where skimming from the roll is to be avoided. Judged by tensile product, continuous milling did not impair the phys. properties of reclaimed rubber or of the mixt. of reclaimed and new rubber to any considerable extent. C. C. DAVIS

Plasticizers, plastics and plasticity. PAUL BARY. *Plastics* 5, 497-9(1929).—See C. A. 23, 2849. E. M. SYMMES

Rubber cements and adhesives. S. D. SUTTON. *India Rubber World* 81, 58-9(1929).—An illustrated description. C. C. DAVIS

The manufacture of tennis shoes. H. BAUFARON. *Déchets et régénérés* 1, No. 2, 5-6(1929).—Formulas contg. reclaimed rubber for use in making different colors and types of shoes are suggested. C. C. DAVIS

An attempt at a rational classification of the principal accelerators of vulcanization. G. MARTIN AND R. THIOLLET. *Rubber Chemistry and Technology* 2, 356-61(1929).—English version of C. A. 23, 4101. C. C. DAVIS

The identification of accelerators in [rubber] mixtures by means of ultra-violet radiation. M. L. P. *Rev. gén. caoutchouc* 6, No. 53, 9-12(1929).—By irradiation of rubber mixts. contg. accelerators with ultra-violet light, the different fluorescent colors and tones of color observed make it possible to identify the particular accelerator which is present (cf. Kirchhof, C. A. 22, 2291, 2855). Characteristic colors are also obtained after vulcanization, though they are different from the corresponding ones before vulcanization. If the color of a control rubber mixt. is compared with that of a doubtful rubber mixt., it is possible in mfg. operations to ascertain whether or not an accelerator is present in the doubtful mixt. With the app. which is described and illustrated, not only may the identity of the accelerator be established but also its approx. quantity within a precision of $\approx 5\%$. Ultra-violet radiation is filtered through CuSO_4 soln. or other suitable filter; it is then reflected on the unknown and on the control sample, then passes through a screen which forms a pencil of light for each sample, next through a cell contg. triphenylmethane, and finally the pencils of light are reflected by means of silvered glass into the eye-piece. To det. the quantity of accelerator, pencils of light from control samples contg. different known proportions of accelerator are passed through a prism, the position of which is thereby calibrated to correspond to each proportion of accelerator. C. C. DAVIS

The mode of action of organic accelerators. II. PAUL BARY. *Rev. gén. caoutchouc* 6, No. 53, 3-5(1929); cf. C. A. 23, 4373.—A further discussion, including vulcanization without S. C. C. DAVIS

The nature of vulcanization. IV. H. P. STEVENS AND W. H. STEVENS. *Rubber Chemistry and Technology* 2, 421-8(1929).—See C. A. 23, 3596. C. C. DAVIS

Developments in a new process of vulcanizing rubber goods. HENRY R. MINOR. *Rubber Age* (N. Y.) 25, 613-4(1929).—Substantially the same as C. A. 22, 1705. C. C. DAVIS

The problem of vulcanization without sulfur. LEO ECK. *India Rubber J.* 78, 354, 356(1929).—English version of C. A. 23, 4847. C. C. DAVIS

Further information on surface vulcanization in the quartz light. R. DITMAR AND O. GRÜNFELD. *Gummi-Ztg.* 43, 2801-3, 2859-61(1929).—In continuation of earlier expts. (cf. D., C. A. 23, 4374), exptl. data show the effects obtained with various accelerators, activators and Vulkan colors in rubber mixts. vulcanized by ultra-violet light. Surface vulcanization by the latter radiation is unquestionably a true vulcanization process, since it was proved that S must be present and that the S is activated by the radiation and then enters into reaction with the rubber. Since ultra-violet light is a very active catalyst, activator and accelerator of surface vulcanization when about 3% S is

present, effecting cures in very short times, the addn. of org. accelerators can be completely dispensed with. Most org. accelerators have an unfavorable action. In most cases, Vulkan colors gave excellent shades of color under these conditions, and in combination with other inorg. and org. colors, such as Se red or methylene blue, all kinds of colors and tones can be obtained. In general vulcanization with ultra-violet light can be effected in 4–8 min. at 20–90°, depending upon the support on which the sample rests, the shortest times being obtained on glass. This influence of the support apparently depends upon its heat cond. and heat capacity, for the higher the temp. prevailing during the vulcanization in ultra-violet light, the more rapid is the rate of the latter.

C. C. DAVIS

The oxidation of vulcanized rubber. A. VAN ROSSEM AND P. DEKKER. *Rubber Chemistry and Technology* 2, 341(1929).—English version of C. A. 23, 2598. C. C. D.

The effect of solvents on the stress-strain curve of vulcanized rubber. A. H. TILTMAN AND B. D. PORRITT. *India Rubber J.* 78, 345–6(1929).—The work is of importance because rubber products often come in contact with org. solvents either during or after manuf. Samples of a vulcanizate, the compn. of which was smoked sheet 57, S 3, Ca(OH), 0.5, ZnO 39.5 (cured 3.25 hrs. at 280°F.), were exposed at room temp. to C₆H₆ vapor for various times to obtain different proportions of absorbed C₆H₆, and were then tested (1) immediately, and (2) after drying to the original wt. The results indicate that the rigidity of vulcanized rubber is diminished considerably by the absorption of small proportions of solvent. Thus at 600% elongation the absorption of 5% (by wt.) of C₆H₆ lowered the rigidity by 21%. The greatest effect was obtained with the first 20–30% of absorbed C₆H₆, further absorption having a less marked effect on the stress-strain curve. The absorption of C₆H₆ had little effect on the ultimate elongation, whereas the tensile strength was lowered considerably. This is, however, probably not true of rubber swollen by immersion in liquid, where absorption is far greater. Absorption followed by complete drying produces a slight, technically negligible, permanent effect on the stress-strain curve. The expts. show that when a solvent must be used, either during manuf. or subsequently, the solvent should be as free as possible from components with high b. ps. All stresses were calcd. on the dimensions of the original dry rubber, and therefore the low rigidity of swollen rubber cannot be ascribed merely to a "dilatn." of the rubber by absorbed liquid, but must be a result of a loosening of the cohesive forces among the ultimate particles.

C. C. DAVIS

Effect of temperature on the acetone extract of vulcanized rubber exposed to sunlight. T. YAMAZAKI. *Caoutchouc and gutta-percha* 26, 14691(1929).—On exposure to sunlight in summer, the acetone ext. of undercured rubber became greater than that of the corresponding rubber when overcured, whereas in winter the contrary was true. The mixt., rubber 92.5, S 7.5, was cured to different degrees and the vulcanizates were then exposed for 100 hrs. to sunlight at 10–5° and at 50–60°, and in another series at approx. 20° and at 60–70°. In each series the acetone exts. increased and the free S decreased far more rapidly at the higher than at the lower temps., and the differences were similar to those obtained in summer and in winter. Therefore the differences obtained in summer and in winter are attributable to differences in temp. rather than to differences in the intensity of the sunlight.

C. C. DAVIS

Some preliminary experiments on the causes of the deterioration of ebonite when exposed to light and air. J. D. FRY AND B. D. PORRITT. *India Rubber J.* 78, 307, 309 10(1929).—On the assumption that the increase in the elec. cond. of hard rubber by exposure to light and air is a result of the formation of a surface film contg. acids, expts. were carried on to ascertain the mechanism of this phenomenon. It was found that H₂S is evolved, the rate of evolution being the greatest in direct sunlight, perhaps, however, because of temp. rather than of light effects. This evolution of H₂S results from decompn. of the rubber-S compd., and occurs in the absence of free S, resins, O and water vapor. The rate of evolution increases with increase of temp.

C. C. DAVIS

Treating latex. JOHN MCGAVACK (to Naugatuck Chemical Co.). U. S. 1,730,518, Oct. 8. A resin solvent in which rubber is substantially insol., e. g., a dil. alc., and an alk. material such as NH₃, are added to latex, which is maintained in uncoagulated state and given increased mechanical stability. Latex thus treated is suitable for coating, impregnation, etc. Numerous examples are given. Cf. C. A. 23, 3375.

Treating rubber latex. ERNEST A. HAUSER (to K. D. P., Ltd.). U. S. 1,729,651, Oct. 1. In producing a compounded product contg. all the solid and dissolved constituents of the original latex and in which the latex is still in a reversible condition, protective agents are added to the latex and it is concd. by evapn. until a completely reversible

colloidal, paste-like product is obtained, compounding and vulcanizing ingredients are gradually mixed with it and are uniformly dispersed and compounded while conserving the colloidal properties and stability of the latex towards friction, pressure, agitation, etc., by effecting and continuing the mixing with the least possible friction. The product is suitable for squirting, pressing or molding.

Rubber composition. CHARLES H. CAMPBELL (to American Glue Co.). U. S. 1,729,709, Oct. 1. A metal albuminate such as that of Fe is mixed with rubber before vulcanization and serves to improve its durability.

Rubber compositions. MERWYN C. TRAGUE (to Naugatuck Chemical Co.). U. S. 1,730,485, Oct. 8. In order to improve the union between rubber and pulverulent materials such as clay or lampblack, the latter are evacuated and treated with NH_3 gas in the presence of moisture so that the gas is adsorbed on and serves to peptize the material and the latter is then combined with the rubber. Cf. C. A. 23, 1527.

Rubber-like composition. JOHN C. WICHMANN (to Cactus Rubber Co. of America). U. S. 1,730,702, Oct. 8. A product which is suitable for use as a rubber substitute comprises a rubber-like material resulting from the boiling of the concd. juice of cactus in assocn. with Na tungstate, Na molybdate, boiled linseed oil and rubber dissolved in turpentine, and drying and oxidizing.

Apparatus for calendering rubberized cord fabric. JOHN F. HOGAN (to B. F. Goodrich Co.). U. S. 1,730,657, Oct. 8. Structural features.

Artificial flowers comprising united layers of sheet rubber. STEWART H. ROGERS. U. S. 1,730,628, Oct. 8. The marginal edges of the rubber are cemented together and stiffening material such as paper or cloth is placed between the rubber layers.

Rubber-coated fabric suitable for ornamenting cloth. MATTHEW LINDENBERG. U. S. 1,730,665, Oct. 8. Cloth is coated with rubber cement, a coating of powdered rosin is applied to the cement, the latter is dried, another coating of the rubber cement is applied and dried, and a layer of gutta percha is applied to the cement-coated surface.

Reclaimed rubber. CHARLES H. CAMPBELL (to American Glue Co.). U. S. 1,729,706, Oct. 1. Rubber scrap is devulcanized by a process of hydrolytic character, in which the material is subjected to the action of cleavage products obtained from collagen. U. S. 1,729,707 specifies cleavage products of keratin instead of those of collagen. U. S. 1,729,708 relates to reclaimed rubber having cleavage products from the hydrolytic decomn. of ox blood compounded with it by an alk. process having a hydrolytic action which renders the ox blood and its hydrolyzed products sol.

Vulcanizing hose. ERNEST BLAKER (to B. F. Goodrich Co.). U. S. 1,730,639, Oct. 8. Hose is distended against an exterior confining device by maintaining a distending fluid such as water under pressure within the hose during vulcanization and the hose is cooled in distended condition by maintaining a cooling fluid under pressure within the hose while causing it to flow through the latter. An app. is described.

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("P" before a page number indicates "Patent")

NOTE.—In the transliteration of names originally written in Russian, the system followed so far as possible is that of *Nature* 41, 390-7 (1890), in which *v* is used instead of the *w* or *f* of other spellings, *sh* instead *sch*, *ch* instead of *tch*, *i* instead of *j* or *y*, etc. Thus Pavlov, not Pawlow; Chugaev, not Tschugaeff. To make quite sure, users of the index should in such a case look under both spellings.

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SUBJECT INDEX

KEY

In using this index the following should be borne in mind:

1. **Subjects**, not words, have been indexed.
2. **Abstracts**, not merely their titles, have been considered in indexing.
3. The small **superior numeral** which accompanies each page number designates the fraction of the page in ninths in which the subject being indexed is first considered. The printed matter only, exclusive of page headings, has been thus subdivided.
4. "P" before a page number indicates that the abstract is of a **patent**.
5. The **alphabetizing of index headings** has been done on the basis first of that part which comes before the comma in such headings as *Copper, metallurgy of* and *Phenol, p-nitro-*. E. g., these headings come before the headings *Copper compounds* and *Phenol condensation products*, respectively.
6. **Organic compounds** are indexed on the basis of "parent compounds," or more accurately, "index compounds" (see Introduction), the names of substituent radicals following in alphabetical order. The system of naming organic compounds which has been used is outlined in the Introduction below. Esters and salts of organic acids are, in general, indexed under the names of the acids; notes in the index under the appropriate headings explain the few exceptions.
7. An **asterisk** (*) following the name of an organic compound entered in the index signifies that the name, or numbering, or both are the author's own and may not conform to the system of nomenclature used in this index. This sign is used where it has seemed inadvisable, owing to incomplete information, to attempt to make the name conform to the system, or where the author's name, differing widely from the one given to the compound by the indexer, is given as an extra entry.
8. A **dagger** (†), which follows the names of a few compounds, signifies that the entry is an extra one, the name being only slightly less favored than the one chosen for the other entry. The preferred name can be determined by reference to the Formula Index.

The desirability of making the index readily usable without the need of reference to an elaborate introduction has been held constantly in mind. Although an introduction seems desirable and should be helpful, nevertheless the index is dependent neither on the Key nor on the Introduction. Numerous cross references are given throughout the index, and notes appear in connection with certain headings. An examination of the Introduction, which follows, should be especially helpful to those interested in looking up organic compounds.

INTRODUCTION

General policy. The indexing of subjects, as opposed to word indexing, has been emphasized. This avoids omissions, scattering and unnecessary entries; with the abundant cross references used it means that one should be able to find all of the references on any subject with certainty and with a minimum of effort. The words used as subject headings or in modifying phrases are not necessarily to be found in the abstracts but an expression of the idea suggested will be found within or beginning in the ninth of the page designated by the small superior numeral following the page number. Chemical compounds have been named and entered systematically; the system used is outlined below. All new compounds and all elements, compounds and other substances for which new data are given have been indexed, with the single exception of new compounds for which no names or structures have been given. Such compounds are entered only in the Formula Index. The Subject Index is in no other respect altered because of the Formula Index.

Modifying phrases. In writing such phrases for the entries under any heading the words have been arranged so that the idea considered to be the most important is expressed at the beginning whenever feasible and this procedure, as well as the selection of the words for this purpose, has been governed by numerous formulated general principles and specific rules. *E. g.*, "detection of" has been used consistently whenever correct at the beginning of the modifications in indexing subjects treated from a qualitative analytical point of view, instead of permitting a scattering under such additional phrases as "test for," "reaction for," etc., regardless of what words may have been used in the text. In the case of appropriate headings the selection of first words for modifications has been made on the basis of a definite system of classification. Under a few large headings two or more entries have been made on indexing a subject in a single abstract in case two or more ideas could be used equally well to start the modifying phrase. In alphabetizing modifying phrases prepositions at the beginning have been ignored.

References to fractions of the page. One can readily estimate ninths of a page with considerable accuracy by placing the fore or middle finger one-third of the distance from the top of the printed matter on the page and the thumb one-third of the distance from the bottom, a procedure very easily carried out.

Inorganic compounds. Simple inorganic compounds are entered under the usual names. In indexing compounds of iron, gold, copper and tin such headings as *Iron sulfates*, under which the "ous" and "ic" salts are entered, have been used rather than headings beginning with "ferric(ous)," "auric(ous)," "cupric(ous)," or "stannic(ous)." Acid salts, such as NaH_2PO_4 , are entered under such headings as "*Sodium phosphates*." With the exception of a few common compounds, such as carbon dioxide and carbon monoxide, compounds of a given element with another or with a definite radical, which differ only in valence relations, are grouped. *E. g.*, the various oxides of nitrogen are grouped under the heading "*Nitrogen oxides*" and classified there. Complex inorganic compounds which cannot be given definite names satisfactory for indexing are usually indexed under the heading which represents the class of compounds concerned and under a heading beginning with the name of the significant element. *E. g.*, dichlorotetraamminecobaltic chloride would be indexed under "*Ammino compounds*" and under "*Cobalt compounds*." The Formula Index, which follows the Subject Index, should be particularly helpful in locating complex compounds.

Organic compounds. The system used for naming and indexing organic compounds is the same as that in use starting with the 1916 volume. An explanation of it by Austin M. Patterson and Carleton E. Curran, who are its originators, has appeared in another

journal of the Society.¹ The system is based on existing usage and follows this as far as is practicable, so that a great many familiar names are unaffected. Only the general principles will be given here, but in the index itself will be found abundant cross references and also notes under *Alcohols*, *Ketones*, etc., indicating how compounds of these classes are named.²

1. The "chief function" of a compound is expressed in the main part of the name wherever possible, and not as a substituent, thus: Pyrrolicarboxylic acid, not carboxypyrrole; ethyl alcohol or ethanol, not hydroxyethane; pentanone, not ketopentane.

2. In compounds of mixed function, the chief function is determined from the following order of precedence:³ "onium" compounds, acid (carboxylic first), acid halide, amide, imide, aldehyde, nitrile, ketone, alcohol, phenol, mercaptan, amine, imine, ether, sulfide (and sulfoxide and sulfone). Thus, hydroxybenzonitrile, not cyanophenol; aminophenol, not hydroxyaniline.

3. A multiple chief function is expressed where feasible as -diol, -dicarboxylic acid, etc., rather than as hydroxy-ol, carboxy-acid, etc. But amino and imino groups attached to cyclic bases are treated as substituents; as, aminopyridine.

4. The index compound should be as large, and the substituents as small, as is practicable in conformity with the above rules; as, ethylbenzene, not phenylethane. But such names as diphenylethane and triphenylcarbinol are exceptions. When the chief function is in a side chain attached to a complex nucleus, "additive" names are preferred in order to harmonize 1 and 4; thus, naphthaleneacetic acid, not naphthylacetic acid (with the result that the compound is indexed with other naphthalene derivatives instead of under acetic acid; see 5).

5. The main part of the name with its functional ending, if any, is placed first in the index, the names of substituents following; thus, chloroacetic acid would appear in the index as *Acetic acid*, *chloro-* and dihydroxyanthraquinone as *Anthraquinone*, *dihydroxy-*. The part thus placed first is called the "index compound"; it may or may not be the "parent compound" (in the second example the parent compound is anthracene).

6. Names in which two functions are expressed in the index compound, as propanolone, cyclopentanonecarboxylic acid, are avoided, except that a few very common ones, such as phenolsulfonic acid, are used (indicated by cross references).

7. The names of the substituent radicals in the name of a compound are arranged in alphabetical order, as, benzylethylmethylphenylammonium chloride. The number of radicals of each kind does not affect the order (e. g., *benzyl* precedes *ethyl* no matter how many of each are present); but the compound name of a substituted radical is treated as a unit with its own alphabetic position; thus *dimethylamino*, Me₂N-, follows *benzyl* but precedes *ethyl*. When the complete name has been formed, it is alphabetized as any other word.

8. Parentheses, brackets and even braces are used where necessary to mark off complex radical names.

9. Familiar methods of numbering are employed (Greek letters for acids, alcohols, etc., and for side chains; arabic numerals for Geneva names and rings). The numbering of complex nuclei is shown in the index under the parent compounds; it is practically identical with that of Richter's "Lexikon" so far as that work goes. For the more

¹ Patterson and Curran, *J. Am. Chem. Soc.*, **39**, 1623-38 (1917).

² For the principles used in naming certain parent ring systems, and especially in distinguishing isomeric forms by the use of bracketed numbers and letters in the middle of the name, see Patterson, *J. Am. Chem. Soc.*, **50**, 3074-87 (1928).

³ This order is an attempt to express, not the relative chemical importance of functions, but general usage in selecting one of them for the ending of the name. For a recent study of the literature on this question see Patterson, *Rec. trav. chim.*, **48**, 1013-17 (1929).

recently discovered forms the "Proposed International Rules for Numbering Organic Ring Systems"¹ have been adopted as a standard.

10. When two or more numberings are equally indicated that one is chosen which gives the smallest number or numbers for the *chief function*, then for double bonds if these must be regarded, then for triple bonds, then for point of attachment (doubled molecules), then for substituents.

11. Unnecessary numbers are avoided: thus, in Δ^1 -1-cyclohexanol the 1 is not needed because by the rules in paragraph 10 the OH group is assumed to be in position 1.

12. Numbers in parentheses are used to indicate the position of entering hydrogen necessary to the existence of the compound; thus, 4(3)-quinolone is equivalent to 3,4-dihydro-4-ketoquinoline.

13. Doubled molecules or radicals are indicated by names commencing with *bi-* (as, *o,o'*-biphenol, biphenyl, $\Delta^{4,4'}$ -bipiperidine). *Bis-* is used for like molecules united by a bivalent radical and for double complex expressions: as, methylenebisphenol, bis(dimethylamino)-.

In using the *cross references*, the *general* nature of many of them should be kept in mind; thus, the reference "*Benzene, ethoxy-*. See *Phenetole*" is applicable not only to this compound itself but to derivatives, which are indexed under it rather than under *Benzene*.

ORGANIC RADICALS

An extensive list of preferred names for organic radicals was given in the 1927 Index in a place corresponding to this and also in the Introduction of the Second Decennial Subject Index. With few exceptions they are the ones in common use. Attention is here called merely to the preferred names for some radicals having more than one name in the literature and to some radical names recently adopted.

BY NAMES

acenaphthenyl $C_{12}H_7$ —
acetyl CH_3CO —
acridyl $C_{12}H_9N$ —
acrylyl $CH_2:CHCO$ —
amyl C_5H_{11} —
anisal *p*- $MeOC_6H_4CH$:
arsono $(HO)_2OAs$ —
arsyl H_2As —
arsylene HAs :
asaryl 2,4,5- $(CH_3O)_2.C_6H_7$ —
benzal C_6H_5CH :
benzenyl C_6H_5C :
benzyl $PhCH(OH)CO$ —
benzofuryl C_8H_5O
benzohydryl Ph_2CH —
boryl $O:B$ —
butylene $-CH_2CH_2CH_2CH_2-$ (1,4-form shown)
camphanlyl (from camphane) $C_{10}H_{17}$ —
camphoroyl (from camphoric acid) $C_9H_{11}(CO)_2$:
camphoryl (from camphor) $C_{10}H_{15}(O)$ —
camphorylidene (from camphor) $C_{10}H_{11}O$:
carbamido H_2NCONH —
carbamy H_2NCO —
carbethoxy $EtOOC$ —
carbomethoxy $MeOOC$ —
carbonyl $OC=$
carbyl $-C=$
cetyl $Me(CH_2)_{11}$ —
cinnamal $PhCH:CHCH$:
citril (from citraldehyde) $C_8H_{11}CH$:
cresotyl (from cresotic acid)
 $(OH)(CH_3)C_6H_4CO$ —
cresyl $(OH)MeC_6H_4$ —

cumal *p*- $Me_2CHC_6H_4CH$:
cyclohexadienyl (5 isomers)

$CH_2CH:CHCH:CH:CH-$ ($\Delta^{1,4}$ -form shown)
cyclohexadienyldiene (2 isomers)

$CH:CH:CH_2CH:CH:C$ ($\Delta^{1,3}$ -form shown)

epoxy $-O-$
ethinyl $HC \equiv C-$
ethinylene $-C \equiv C-$
ethylene $-CH_2CH_2-$
fenchyl (from fenchyl alcohol) $C_{10}H_{17}$ —
fluorylidene (from fluorene) $C_{10}H_7$:
formyl $OHC-$
fural C_4H_3OCH :
furyl C_4H_3O-

furylidene (2 isomers) $CH:CH:O:CH_2C:$ (3(2)-form shown) ^a 4 ^b 1 2 3

guanido $H_2N.C(:NH).NH-$
guanyl $H_2N.C(:NH)-$
hippuryl $PhCONHCH_2CO-$
indylidene (from indole) C_8H_7N :
isonitro $HOON$:
isonitroso HON :
isopropenyl $MeC(:CH_2)-$
keto O :
mercapto $HS-$
mesityl (from mesitylene) C_6H_3 —
methionyl $-SO_2CH_2SO_2-$
naphthal $C_{10}H_7CH$:
naphthyldiene $C_{10}H_7$:
oxy $-O-$

¹ Patterson, *J. Am. Chem. Soc.*, **47**, 542-61 (1925).

perthio (*replacing O only*) S:S:

phenacyl PhCOCH_2-

phenacylidene PhCOCH:

phenanthrylene (*from phenanthrene*) C_{14}H_8 :

phenylenedisazo $-N:N\text{C}_6\text{H}_4\text{N:N}-$

phenylidene = cyclohexadienylidene

phthalidene (*from phthalide*) $\text{C}_6\text{H}_4\text{CO.OC}-$

phthalidyl (*from phthalide*) $\text{C}_6\text{H}_4\text{CO.O.CH}-$

piperonyl 3,4 $(\text{CH}_2\text{O})_2\text{C}_6\text{H}_3\text{CH}_2-$

pivalyl (*from pivalic acid*) $(\text{CH}_3)_3\text{CCO}-$

propenyl $\text{MeCH:CH}-$

propenylidene $\text{CH}_2\text{CH:C:}$

pseudocumyl $(\text{CH}_3)_2\text{C}_6\text{H}_2-$

pyranlyl $\text{C}_4\text{H}_3\text{O}-$

pyridylidene $\text{C}_5\text{H}_4\text{N:}$

quinonyl $(\text{O})_2\text{C}_6\text{H}_2-$

quinoxalyl (*from quinoxaline*) $\text{C}_8\text{H}_6\text{N}_2-$

salicyl $o\text{-HOC}_6\text{H}_4-$

salicylal $o\text{-HOC}_6\text{H}_4\text{CH:}$

salicylyl $o\text{-HOC}_6\text{H}_4\text{CO}-$

selenyl $\text{HSe}-$

semicarbazido $\text{H}_2\text{NCONHNH}-$

stannyl $\text{H}_2\text{Sn}-$

stibono $(\text{HO})_2\text{OSb}-$

stibyl $\text{H}_2\text{Sb}-$

stibylene HSb:

styryl $\text{PhCH:CH}-$

sulfinyl OS:

sulfonyl $\text{O}_2\text{S:}$

terephthalal (*from terephthalaldehyde*) $:\text{HCC}_6\text{H}_4\text{:}$

CH:

thenoyl (*from thiophenecarboxylic acid, 2 isomers*) $\text{C}_4\text{H}_3\text{SCO}-$

thienyl (*from thiophene*) $\text{C}_4\text{H}_3\text{S}-$

toloxyl $\text{MeC}_6\text{H}_4\text{O}-$

toluino $\text{MeC}_6\text{H}_4\text{NH}-$

α tolyl $\text{PhCH}_2\text{CO}-$

tolyl MeC_6H_4-

triazinyl (*from triazine*) $\text{C}_3\text{H}_2\text{N}_4-$

triazol N_3-

veratryl 3,4- $(\text{CH}_3\text{O})_2\text{C}_6\text{H}_3\text{CH}_2-$

RING INDEX

The following index of *ring complexes* is arranged as shown by the bold-face figures: 1-Ring Systems, with single figures indicating simple rings of 3, 5, etc., members; 2-Ring Systems, two figures denoting double rings of 3 and 4, 3 and 5, etc., members; then the triple and still more complex forms. Under each combination of figures the kind and number of atoms in the ring or rings are expressed in formulas. These formulas are arranged so that their initial rings are in the same order as in the Formula Index (see Key at the beginning of it). If the initial rings are alike the second rings of the formula are considered, and so on. By this means the reader will be able to learn the name used in the index for the simplest parent compound containing any particular ring or combination of rings and by turning to this name in the index he will find the compound listed and, perhaps, cross references to names of derivatives. Rings which are united but which have no atoms in common (e. g., biphenyl) and "spiro" compounds¹ which are characterized by two rings having but one atom in common are not regarded as ring complexes nor included in this index.

To illustrate: **6,6,6** $\text{C}_4\text{N}_2\text{-C}_6\text{-C}_6$ Benzophthalazine

Benzoquinoxaline

Phenazine

(1) This designates a complex ring of three components, each of six members; (2) the first is heterocyclic, containing four carbon atoms and two nitrogen atoms and the other two are carbocyclic rings of six atoms each; (3) parent compounds of this configuration will be found in the index under the three names given. If derivatives are indexed a structural formula will be found with the proper numbering and also appropriate cross references to derivatives having other common names, if any such are in the index.

It should be noted that the classification is made with reference to the smallest rings which, placed together, will constitute the plane formula. Thus hexamethylene-tetramine is treated as a 6,6,6 complex although a fourth six-membered ring (composed of atoms from the three six-membered rings) is also present.

1-RING SYSTEMS

3 CNO Methyleneoximinio derivatives

3 C₂O Ethylene oxide

4 C₃ Cyclopropane

4 C₂N₂ Diazo

4 C₂N Trimethylenimine

3 C₃O Cinnamic acid. α -amino- β -hydroxy-, lactone

3 Crotonic acid, α -benzalmino- β hydroxy-, lactone

3 Trimethylene oxide

4 C₄ Cyclobutane

¹ All members of this class will be found together under "Spiro-" in the Subject Index.

- Si₄ Cyclosilicotetrasilane, octaphenyl.*
- 5 A₅ Pentarsenole
 CN₂S₂ Dithiodiazole
 CN₄ Tetrazole
 C₂NS₂ Dithiazole
 C₂N₂O Furazan
 Oxdiazole
 C₂N₂S Thiodiazole
 C₂N₃ Triazole
 C₂S₃ Trithiolane
 C₂NO Isoxazole
 Oxazole
 C₂NS Thiazole
 C₂N₂ Imidazole
 Isopyrazole
 Pyrazole
 C₂O₂ Dioxolane
 Dioxole
 C₂S₂ Dithiole
 C₂N Isopyrrole
 Pyrrole
 C₄O Furan
 C₄S Thiophene
 C₄Se Selenophene
 C₅ Cyclopentadiene
 Cyclopentane
 Cyclopentene
 6 C₂N₂O₂ Dioxdiazine
 C₂NS₂ Dithiazine
 C₂N₂O Isoxdiazine
 Oxdiazine
 C₂N₂S Thiodiazine
 C₂N₃ Triazine
 C₂O₂S 1,3-Propanediol, 2-(hydroxymethyl)-2-nitro-, cyclic sulfite
 C₂S₃ Trithiane
 C₄NO Oxazine
 C₄NS Thiazine
 C₄N₂ Pyrazine
 Pyrimidine
 C₄OS Thioxane
 C₄O₂ Dioxane
 Dioxin
 C₄Se₂ Diseleninane
 C₄N Piperidine
 Pyridine
 C₆O Pyran
 C₆Te Telluropyran
 C₆ Benzene
 Cyclohexadiene
 Cyclohexane
 Cyclohexene
 7 C₄NO₂ Cyclo - 2,4,6,7 - tetramethylene - 1,3,5-dioxamine*
 C₄N₂S Compd., m. 201-2°, from CH₂(C(OCl))₂ and α-phenylthiocarbonylhydrazide, 1398¹
 C₄O₂S 2,5-Hexanedione, cyclic ester with H₂S(O)₄
 C₄N₂ Diazepine
 C₄N Hexamethylenimine
 C₇ Cycloheptane
 Cycloheptene
 8 C₄N₂S 1,3,4-Thiooctadiazine*
 C₆O₂ 1-Propanol, 1,3-epoxy-, dimer
 C₇N Heptamethylenimine
 9 C₂O₂ Triacetone cycloperoxide*
 C₈S₄ Pentamethylene tetrasulfide*
 10 C₈O₂ Dioxecadiene
 12 C₁₃ Cyclotridecane
 14 C₁₈O Tridecanoic acid, μ-hydroxy-, lactone
 C₁₄ Cyclotetradecane
 15 C₁₀O Myristic acid, ν-hydroxy-, lactone
 C₁₀ Cyclopentadecane
 16 C₁₆O Pentadecanoic acid, ξ-hydroxy-, lactone
 C₁₆ Cyclohexadecane
 17 C₁₆O Juniperic acid, lactone
 C₁₇ Cycloheptadecane
 Cycloheptadecene
 18 C₁₇O Margaric acid, ν-hydroxy-, lactone
 19 C₁₉ Cyclononadecane
 21 C₂₁ Cycloheneicosane
 29 C₂₉ Cyclononacosane
- 2-RING SYSTEMS**
 3,3 CNO-CN₂ Hydrazomethylene, 1,3-endoxy.*
 3,4 C₂O-C₄ Bicyclo[2.1.0]-5-oxapentane
 3,5 CNO-C₂N₂O Furoxan
 C₃C₄N Caronimide
 C₃-C₄O 1,2-Cyclopropanedicarboxylic anhydride
 C₂-C₃ Bicyclo[0.1.3]hexane
 3,6 C₂N-C₆ Benzene-1,2-imine(?)
 C₂O-C₄O Bicyclo[4.1.0]-3,7-dioxahexane
 C₃O C₄ Cyclohexane, epoxy-
 C₃ C₄ Norcarane
 4,5 CN₂O-CN₂ Tetrazole, 3,5-endoxy.*
 C₄ C₄N Cyclobutanedicarboxylic acid, 2-(aminomethyl)-, cyclic lactam
 1,2-Cyclobutanedicarboximide
 C₄ C₅ Bicyclo[0.2.3]heptane
 4,6 C₂N C₄ Benzazete
 Bicycloazaheptanone
 C₄-C₆N Norpinimide
 C₄ C₄ Norpinane
 5,5 C₂NS-C₃N₂ Imidazothiazole
 C₃N₂ C₃ Cyclopentapyrazole
 C₄N-C₄N Benzene 1,4-imine(?)
 C₄N-C₄ Cyclopentanedicarboxylic acid, 2-(aminomethyl)-, cyclic lactam
 1,2-Cyclopentanedicarboximide
 C₄O-C₄O Atromentic acid, lactone
 Bicyclo[2.2.1] 7-oxaheptane
 Bicyclo[2.2.1] 7-oxa-5-heptene
 Pulvic acid, p,p'-dimethoxy-, lactone
 C₄O-C₄ Δ³ Cyclopenteneacetic acid, 2-hydroxy-5-ketotetramethyl-γ-lactone
 C₄-C₄ Norcamphane
 5,6 C₂N₂O-C₄ Benzoxthiazole
 C₂N₂S C₄ Benzothiodiazole
 C₂N₂ C₄ Benzotriazole
 C₂HgO C₄ Benzoic acid, 2-(hydroxymethyl)-, anhydride
 Terephthalic acid, 2-(hydroxymethyl)-, anhydride
 C₂NO-C₄ Benzisoxazole
 Benzoxazole
 C₂NS-C₄ Benzisothiazole
 Benzothiazole
 C₂NSe C₄ Benzoselenazole
 C₂N₂-C₄O Pyranopyrazole
 C₂N₂-C₄ Benzimidazole
 Indazole
 Isoindazole
 C₂OS C₄ Benzisothioxole
 Benzothioxole
 C₄N C₄N Pyrrolopyridine
 C₄N-C₄ Indole
 Isoindole
 Pseudoindole
 Pseudoisoindole
 C₄O-C₄N Europyridine
 C₄O-C₄ Benzofuran
 Δ^{1,4} - 1,2 - Cyclohexadienedicarboxylic anhydride
 Isobenzofuran
 C₄S-C₄ Isothionaphthene
 Thionaphthene

- C₄Se-C₄** Selenonaphthene
C₄Te-C₄ Telluronaphthene
C₅-C₅N Camphidine
C₅-C₅ Indene
5,7 C₅N₄-C₅N α, β - Cyclopentamethylenetetrazole*
6,6 C₅HgNO-C₄ *o*-Benzenone, 4,6-bis(hydroxymercuri)-2-isonitro-, 2,4-anhydride
p-Benzenone, 2,6-bis(hydroxymercuri)-4-isonitro-, 2,4-anhydride
p-Benzenone, 2-(hydroxymercuri) - 4 - isonitro - 6 - nitro-, 2,4 - anhydride
C₅HgOS-C₅ Salicylic acid, 3-(hydroxymercuri)-5-sulfo-, cyclic mercuric sulfonate
C₅N₂-C₅N₂ Bicyclo[3.3.1]-2,4,6,8,9-pentazon-5-ene
C₄N₂-C₄ Benzotriazine
C₄NO-C₄ Benzisoxazine
Benzoxazine
C₄N₂-C₄ Cinnoline
Phthalazine
Quinazoline
Quinoxaline
C₄O₂-C₄ Benzodioxan
C₄N-C₄N Granatanine
Pyridopyridine
C₄N-C₄ Isoquinoline
Quinoline
C₄O-C₄ Malonic acid, (γ, γ -dihydroxy- α, α -dimethylbutyl)-, dilactone
C₄O-C₄ Benzopyran
C₄S-C₄ Benzothiopyran
C₄-C₄ Naphthalene
6,7 C₆-C₅N₄O 3,4 - Benzo - 1,2,5,6 - oxheptatriazine*
C₆-C₅N₄ 3,4 - Benzo - 1,2,5,6 heptatetrazine*
C₄-C₅N₂S 6,7 - Benzo - 1,3,4 - thioheptadiazine*
C₄-C₅N₂ Compd. from malonic acid and *o*-phenylenediamine, 141*
Guanidine, p-aminophenyl-*p*-phenylene*
Guanidine, phenylthiocarbamidophenyl-p phenylene*
C₄-C₄N *p*-Indole
C₄-C₄ Benzocycloheptadiene
6,8 C₄-C₄N₄ 2,3-Benzo-1,4,5,7-octatetrazine*
C₄-C₄N₂S Compd., m. 206°, from *o*-C₆H₄(COCl)₂ and α -phenylthiocarbohydrazide, 1398¹
C₄-C₄NO Phthalamic acid, *N*-(α -carboxy- β, β -diphenylethyl), anhydride
6,9 C₄-C₄O Valerolactone peroxide, δ -salicyl-*
- 3-RING SYSTEMS**
3,5,8 C₃-C₃-C₃ Tricyclo[2.2.1.0^{3,4}]heptane
4,5,8 C₄-C₃-C₃ Dicyclopentadiene*
5,5,5 C₄OS-C₄-C₄ Camphane- ω -sulfonic acid, 2-hydroxy-*, lactone, 3458¹
C₄O-C₄O-C₄O Bicyclo[2.2.1]-7-oxaheptane-2,3-dicarboxylic anhydride
Bicyclo[2.2.1] - 7 - oxa - 5 - heptene - 2,3 dicarboxylic anhydride
C₄O-C₄-C₄ Δ^4 - 2,3 - Bicyclo[1.2.2]heptene-dicarboxylic anhydride
5,5,6 C₃N₂-C₃N₂-C₃N₂ Dipyrazopyrazine
C₃O₂-C₄O-C₄ Cyclohexanecarboxylic acid, 4,5 - dihydroxy - 1,2 - isopropylidenedioxy-, γ -lactone
C₄O-C₄O-C₄ 1,2 - Cyclohexanedicarboxylic acid, 3,6-bis(hydroxymethyl)-, dilactone
- 1,2,3,4 - Cyclohexanetetra-carboxylic dianhydride
 Δ^4 - 1,2 - Cyclohexenedicarboxylic acid, 3,6-bis(hydroxymethyl)-, dilactone
5,6,6 C₃N₂O-C₃-C₃ Naphthoxdiazole
C₃N₂-C₃-C₃ Naphthotriazole
C₂HgO-C₃N-C₃ Cinchophen, 3-(hydroxymercuri)-, cyclic anhydride
C₃NO-C₃N-C₃ 1,2(2)-Quinolinedicarboxylic anhydride
C₂NS-C₃-C₃ Naphthisothiazole
Naphthothiazole
C₂S₂-C₃-C₃ Naphthodithiole
C₄N-C₃N₂S-C₃ Thiodiazinoindole
C₄N-C₃N₂-C₃ Pyrroloquinoxaline
C₄N-C₃-C₃ Carbazole
Naphthazole
Naphthostyryl
C₄O-C₄N₂-C₃ 2,3 - Quinoxalinedicarboxylic anhydride
C₄O-C₃-C₃ Dibenzofuran
Isonaphthofuran
C₄S-C₃-C₃ Dibenzothiophene
Thiophanthrene
C₃-C₃-C₃ Acenaphthene
Fluorene
Naphthindan
5,6,7 C₄N-C₃-C₃ Cycloheptindole
6,6,6 C₃N₂-C₃N₂-C₃N₂ Hexamethylenetetramine
C₄AsN-C₃-C₃ Phenarazine
C₄HgO-C₃-C₃ 1-Naphthoic acid, 8-(hydroxymercuri)-, 1,8-anhydride, 3463¹
C₄NO-C₃-C₃ Isophenoxazine
Phenoxazine
C₄NS-C₃-C₃ Isophenothiazine
Phenothiazine
C₄NSe-C₃-C₃ Phenoselenazine
C₄N₂-C₃-C₃ Benzophthalazine
Benzoquinoxaline
Phenazine
C₄OS-C₃-C₃ Phenothioxin
C₄OS₂-C₃-C₃ Phenoxaselenin
C₄O-Te-C₃-C₃ Phenoxatellurin
C₄O₂-C₃-C₃ Dibenzodioxin
C₄S₂-C₃-C₃ Naphthodithiin
Thianthrene
C₄Se₂-C₃-C₃ Selenanthrene
C₃N-C₃-C₃ Phenanthroline
Pyridoquinoline
C₃N-C₃-C₃ Acridan
Acridine
Benzisoquinoline
Benzoquinoline
C₃O-C₃-C₃ Dibenzopyran
Isoxanthene
Naphthopyran
Xanthene
C₃S-C₃-C₃ Naphthothiopyran
Thioxanthene
C₃Se-C₃-C₃ Selenoxanthene
C₃-C₃-C₃ Anthracene
Benzonaphthene
peri-Naphthindan
Phenanthrene
6,6,7 C₃N-C₃-C₃ Cycloheptaquinoline
C₃-C₃-C₄OS₂ Oxydiphenylene disulfide*
C₃-C₃-C₃N₂ Dibenzodiazepine
C₃-C₃-C₄O Diphenide
6,6,8 C₃-C₃-C₄OS₂ *p*-Toluenesulfonic acid, 2-hydroxy-5-sulfamyl-, bimol. cyclic sulfonylide
C₃-C₃-C₃N₂ 2,3,7,8-Dibenzo-1,4,5-octatri-

C₈-C₈-C₈N₂ Phenomazine

C₈-C₈-C₈O₂ Compd., m. 82-3°, from acetone and *m*-cresol, P 1140¹

C₈-C₈-C₈ *p*-Diphenylene

6,6,10 C₂-C₈-C₈N₂ 2,3,9,10-Dibenzo-1,4,5,7,8-decapentazine*

C₈-C₈-C₈S₂ Diphthalyl disulfide*(?)

C₈-C₈-C₈O 4-Heptanone, 2,6-di(2,5-cresyl)-2,6-dimethyl-, cyclic anhydride

6,6,13 C₈-C₈-C₈As₂N₂ Carbanilide, *p,p'*-arsenothio-

4-RING SYSTEMS

4,6,6,7 C₂NO-C₈-C₈-C₄N₂ 1,3,6 - Heptatriazine, 1 - carbethoxyaminonaphthyl - 4,5-naphthylene - 2,7 - endoxy-*

C₂OS-C₈-C₈-C₄N₂S 1,3,6 - Thioheptadiazine, 4,5-naphthylene-2,7-endoxy-*

5,5,6,6 C₃NO-C₈-C₈-C₈ Acenaphthoxazole

C₃N₂-C₈-C₈-C₈ Acenaphthimidazole

C₃N-C₈S-C₈-C₈ Thionaphthindole

C₄N-C₈-C₈-C₈ Indenoinole

C₃-C₈-C₄N₂-C₈ Camphanoquinoxaline

5,6,6,6 C₃HgO-C₈-C₈-C₈ 2-Antraquinonecarboxylic acid, (hydroxymercuri)-, anhydro deriv.

C₃NO-C₈-C₈-C₈ Phenanthroxazole

C₃N₂-C₈-C₈-C₈ Anthrapyrazole

C₃O₂-C₈-C₈-C₈ Dioxolophenanthrene

C₄N-C₄N₂-C₈-C₈ Indoloquinoxaline

C₄N-C₈N-C₈-C₈ Indoloquinoline

C₄N-C₈-C₈-C₈ Anthrapyrrole

Benzocarbazole

C₄O-C₈-C₈-C₄ 1-Anthroic acid, 9,10-dihydroxy-, γ -lactone

γ -Brazon

Phenanthrofurane

C₄S-C₈-C₈-C₈ Benzothiophanthrene

C₈-C₄N₂O-C₈-C₈ Acenaphthoxdiazine

C₈-C₃O-C₈-C₈ Benzozindenopyrylium

C₈-C₈-C₈-C₈ Benzofluorene

Chrysofluorene

Fluoranthene

6,6,6,6 C₃N₂O-C₈-C₈-C₈ Phenanthroxdiazine

C₄AsN-C₈-C₈-C₈ Benzophenarsazine

C₄NS-C₈-C₈-C₈ Anthriothiazine

C₄N₂-C₈-C₈-C₈ Benzophenazine

Naphthophthalazine

C₄N-C₄N-C₈-C₈ Dibenzquinolizine

C₄N-C₈-C₈-C₈ Benzacridine

Naphthisoquinoline

Naphthoquinoline

C₄O-C₈-C₈-C₈ Benzonaphthopyran

Benzoxanthene

C₄S-C₈-C₈-C₈ Benzothioxanthene

C₈-C₈-C₈-C₈ Benzanthrene

Chrysene

6,6,6,7 C₈-C₈-C₈-C₈N₂O 3,4-Phenanthro-7-keto-1,2,5,6-heptaotriazine*

6,6,6,8 C₄N₂-C₈-C₈-C₈N₂ Quinoxaline 2,3 dicarboxy-*o*-phenylenediamide*

C₈-C₈-C₈-C₈N₂O Anhydro- β -naphtholsulfonic-*o*-azobenzyl alcohol*

C₈-C₈-C₈-C₈N₂ Anhydro- β -naphthylamine-*o*-azobenzyl alcohol*

5-RING SYSTEMS

5,5,5,5,16 C₄N-C₄N-C₄N-C₄N-C₁₂N₄ Coproporphyrin

Deuteroporphyrin

Homocoproporphyrin

Mesoporphyrin

Porphintetrapropionic acid, tetraethyl-*

5,5,6,6,6 C₄O-C₄O-C₈-C₈-C₈ 1,5-Anthracenedicarboxylic acid, 9,10-dihydroxy-, di- γ -lactone

C₈-C₈-C₄N₂-C₈-C₈ 1,2-Benzocamphorquinoxaline*

5,6,6,6,6 C₂N₂-C₈N₂-C₈-C₈-C₈ Benzotriazolophenazine

C₃NO-C₈-C₈-C₈-C₈ Benzanthroxazole

C₃N₂-C₈N-C₄N-C₈-C₈ Diquinolisoimidazole

C₄N-C₈-C₈-C₈-C₈ Naphthocarbazole

C₄O-C₈-C₈-C₈-C₈ Dinaphthofuran

C₈-C₈AsN-C₈-C₈-C₈ Acenaphthobenzarsazine

C₈-C₈-C₈-C₈-C₈ Dibenzofluorene

6,6,6,6,6 C₄AsN-C₈-C₈-C₈-C₈ Dibenzophenarsazine

C₄NO-C₄NO-C₈-C₈-C₈ Triphenodioxazine

C₄NS-C₄NS-C₈-C₈-C₈ Triphenodithiazine

C₄N₂-C₄N₂-C₈-C₈-C₈ Quinoxalophenazine

C₄OS-C₄OS-C₈-C₈-C₈ Compd. from 4,6-dimercaptosoreinol, 826¹

C₄OS-C₈-C₈-C₈-C₈ Dibenzophenothioxia

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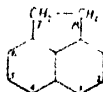
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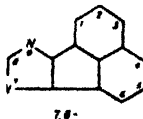
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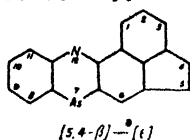
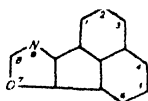
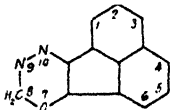
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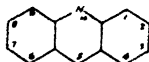
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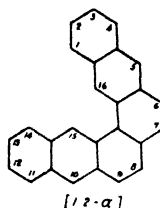
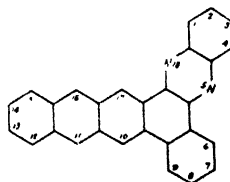
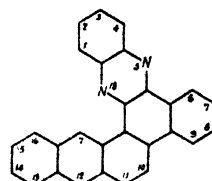
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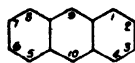
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—, 9 (and 10)-benzyl-2-methyl-, 5183¹.

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—, 9 - bromo - 10 - (bromomethyl) - 2 - methyl-, 5183¹.

—, 10 - bromo - 9 - (bromomethyl)-2-methyl-, 5183¹.

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—, 9 - bromo - 2 - methyl - 10 - (1 - piperidylmethyl)- \dagger , 5183¹.

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—, 1 - chloro - 10 - α - methoxybenzyl-, 1408².

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—, 1,5 - dichloro - 9 - α - ethoxybenzyl-10-phenyl-, 1408².

—, 1,5 - dichloro - 9 - (ethoxymethyl) - 10-phenyl-, 3222².

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—, 9,10-dihydro-, formation and reduction of 2018².

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—, 9,10-dihydro-9-keto-. See *Anthrone*.

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$$\text{HO}_2\text{C} \cdot \text{C}(\text{NH}_2) \cdot \text{CH} : \text{CH} \cdot \text{CH} : \text{CH}$$

$$\begin{matrix} & 1 & 2 & 3 & 4 & 5 & 6 \end{matrix}$$
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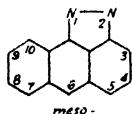
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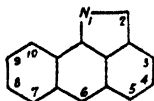
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- 4 - *meso* - Anthrapyrrol - 6(2) - one, 3 - hydroxy-, and benzoate, 2173².

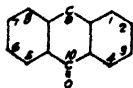
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- , 1,5-dihydroxy-. See *Anthrarufin*.
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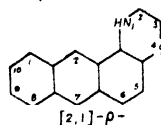
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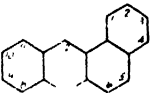
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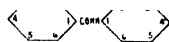
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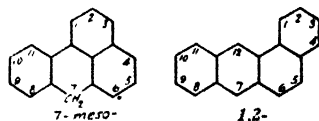
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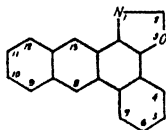
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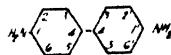
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—, 1,2-dihydro-2-(β -1-naphthylhydrazino)-, 4680⁶.

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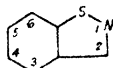
—, 1,2-dihydro-2- β -phenylhydrazino-, 4680⁶.

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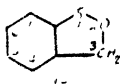
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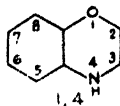
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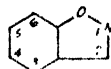
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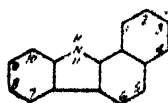
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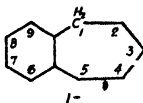
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1,3-Benzodiazine. See *Quinoxaline*.

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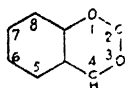
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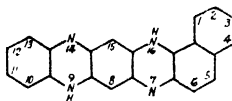
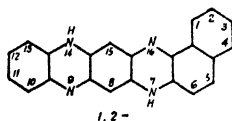
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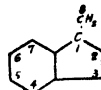
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1,2 - Benzofluorindine, 5 - acetamido-14-phenyl-(?), 1895⁴.

3,4 - Benzofluorindine, 5 - acetamido-9-phenyl-(?), 1895⁴.

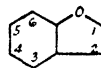
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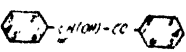
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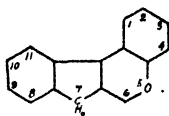
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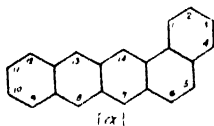
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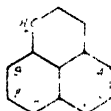
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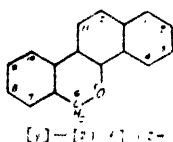
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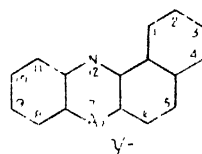
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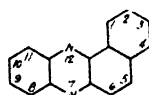
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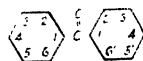
Benzoparadiazine. See Quinoxaline.

 γ -Benzophenarsazine,—, 7-bromo-7,12-dihydro-, 4174⁹.—, 7-chloro-7,12-dihydro-, 4474⁹.—, 7,12-dihydro-7-iodo-, 4474⁹.

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 α - Benzophenazine, 5(?) - (*o* - carboxyphenylsulfanyl)-, 1901⁸.Benzophenazonium compounds, α -, P 2043⁹.*p*-Benzophenetide,—, 2',6'-dichloro-, 3910³.

Benzophenone (diphenyl ketone),

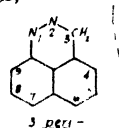
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 —, o-benzyl-, and phenylhydrazone, 1409^{4,7}.
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 —, 3-bromo-4'-chloro-4-methyl-, 130³.
 —, p-(bromomethyl)-, 4943².
 —, 3-bromo-4-methyl-, 129⁸.
 —, 3-bromo-4-methyl-3',5'-dinitro-, 130³.
 —, 3-bromo-4-methyl-3'-nitro-, 130³.
 —, 3-bromo-4-methyl-4'-nitro-, 130³.
 —, 2(3 and 4)-bromo-4'-phenyl-, 3922³.
 —, p,p''-1,4-butylenedio-, 4943¹.
 —, 4-chloro-4'-methyl-3,3'-dinitro-, 130³.
 —, 4'-chloro-4-methyl-3,5-dinitro-, 130³.
 —, 4-chloro-4'-methyl-3-nitro-, 130³.
 —, 4'-chloro-4-methyl-3-nitro-, 130³.
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 —, 3,3'-diamino-4-methyl-, 4687⁶.
 —, 5,4'-diamino-4-methyl-3-nitro-, 130¹.
 —, 3,3'(and 3,4')-dibromo-, 3922³.
 —, 2,4-dihydroxy-6-methoxy-. See *Isoctoin*.
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 —, 2,4-dimethyl-, nitration of, 4687².
 —, 2,4-dimethyl-3,5(3',5 and 3',5')-dinitro-, 4687⁷.
 —, 2,4-dimethyl-3(and 5)-nitro-, 4687^{6,7}.
 —, 2,4-dimethyl-3,3',5,5'-tetranitro-, 4687⁷.
 —, 2,4-dimethyl-3,3',5-trinitro-, 4687⁷.
 —, 3,5-dinitro-, 4687⁶.
 —, 4-hydroxy-2,6-dimethoxy-, 830⁹.
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 —, 2-isopropyl-4-methoxy-5-methyl-, 1123¹.
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 —, 4-methyl-3,3',5,5'-tetranitro-, 4687⁶.
 —, 4-methyl-3,5,3',4'-tetranitro-, 130¹.
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 —, 4-methyl-3,5,4'-trinitro-, 129⁹.
 —, p-nitro-, α and β-oxime, ionization consts. of, 3681⁷.

- , 2,4,4',6-tetrahydroxy-, 4'-Et carbon-ate, 2162².
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 —, thio-, autoxidation of, 130⁴.
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- 3-*peri*-Benzophthalazine-3,9(2)-dione, 2-(p-nitrophenyl)-, 2435⁸.

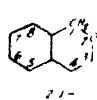
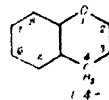
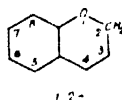
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- , s-3,3'(and 4,4')-dibromo-, 3922².
 —, s-4,4'-dibromo-s-4',4'''-dichloro-, 3922².
 —, s-3,3'(and s-4,4')-dibromo-s-4',4'''-diphenyl-, 3922^{2,4}.
 —, s-o,o'-dichloro-, 5182².
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Benzopurpurin, coagulation of, by electrolytes, 1552^{1,4}.
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- 1,2-Benzopyran, 3,4-dihydro-. See *Chroman*.

—, 2-keto-. See *Coumarin*.

- 1,4-Benzopyran, 2,3-dihydro-. See *Chroman*.

—, 3-(3,4-dimethoxyphenyl)-5,7-dimethoxy-, 4681⁴.

—, 4-keto-. See *Chromone*.

- 2,1-Benzopyran, 3,4-dihydro-. See *Chroman*.

- 1,2-Benzopyran-3-acetic acid, 3,4-dihydro-3-hydroxy-4-keto-7-methoxy-, 4180⁹.

- 1,2-Benzopyran-3-carboxylic acid, 6(or 8)-acetyl-8(or 6)-ethyl-5-hydroxy-2-keto-, ethyl ester, 3219⁷.
 —, 6,8-diethyl-5-hydroxy-2-keto- and ethyl ester, 3219⁷.

- 1,4-Benzopyran-2-carboxylic acid, 3-p-anisyl-5,7-dimethoxy-, 2180⁹.
 —, 4-keto-7-methoxy-3-phenyl-, 4702⁹.

- 2,1-Benzopyran-3-carboxylic acid, 1-keto-5,6,7-trimethoxy-, derivs., 3699⁸.

- 2,1-Benzopyran-1,3(4)-dione, enolization of, 599⁹.

- , 8-bromo-7,8-dimethoxy-4-methyl-, 842⁹.

- , 7,8-dimethoxy-4-methyl-, 843¹.

—, 5,7 - methylenedioxy-, enolization of, 599^a.

—, 5,6,7-trimethoxy-, 3699^a.

Benzopyransulfonic acid, 2-keto-. See *Coumarinsulfonic acid*.

Benzopyrazole. See *Indazole*; *Isindazole*.

1,2-Benzopyrone. See *Coumarin*.

1,4-Benzopyrone. See *Chromone*.

—, 2,3 - dihydro - 2 *g* phenyl-. See *Flavanone*.

—, 2-phenyl-. See *Flavone*.

2,1-Benzopyrone. See *Isocoumarin*.

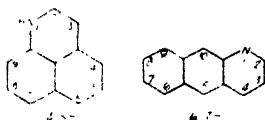
6,7 - Benzo - α - pyrquinizarin. See 6,7 β - Naphthoquinoline - 5,12 - dione, 6,11-dihydroxy-.

Benzopyrrole. See *Indole*.

Benzopyrylium compounds, 2-phenyl-— see *Flavonium compounds*.

Benzoquinol. See *Quinol*.

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4,5 - Benzoquinoline - 2,3 - dione, P 613^a.

6,7 - Benzoquinoline - 5,10 - dione, 6,9-dihydroxy-, and sodium deriv., 3471^b & spectrum of, 3929¹.

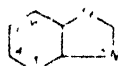
Benzoquinone. See *Quinone*.

5,6 - Benzoquinoxaline (naphthopyrazine),



—, 2,3-dimethyl-, salt with dimethylglyoxime, 2978^a.

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—, 1,2-dihydro-. See *Benzoselenazoline*.

—, 1-methyl-, and derivs., 142².

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2-ethyl-1-methyl— iodide, 142².

2 - methyl - 1 - [γ - [2 - methyl - 1(2) - benzoselenazylidene]propenyl]— iodide, 142².

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arsenicals of arspenamine type, 5184².

—, 1 - acetamido - 3,5 - dimethyl-, and hydrotribromide, 8705^a.

—, 1 - acetamido - 3 - methyl-, 835^a.

—, 1-(6-acetamidosalicyl)-, acetate, 5184².

—, 1-(*N*-acetylanilino)-, derivs., 2973^a &.

—, 1 - (*N* - acetyl - *p* - bromoanilino)-5-bromo-, 2973^a.

—, 1 - (*N* - acetyl - *p* - chloroanilino)-5-chloro-, 2973^a.

—, 1 - amino - 5 - bromo - 3 - methyl-, -HBr, and dibromide, 835^a &.

—, 1 - amino - 3,5 - dimethyl-, and methosulfate, 3705^a &.

—, 1-amino-5-ethoxy-, 2245¹.

—, 1-amino-3-methyl-, derivs., 835^a.

—, 1-anilino-, hexabromide, 2973^a.

—, 1-*p*-bromoanilino-, and dibromide-HBr, 2973^a.

—, 5 - bromo - 1 - *p* - bromoanilino-, and derivs., 2973^a &.

—, 5-bromo-1-chloro-, 2973^a.

—, 5 - bromo - 1 - heptylamino - 3 - methyl-, and -HBr, 835^a.

—, 5-bromo-1-methyl-, 390^a.

—, 5 - bromo - 3 - methyl - 1 - propylamino-, and -HBr, 835^a.

—, 1-*p*-chloroanilino-, 2973^a.

—, 5 - chloro - 1 - *p* - chloroanilino-, and derivs., 2973^a.

—, 5 - chloro - 1,3 - dimethyl-, 390².

—, 4(7) - chloro - 5 - methoxy - 1-methyl-, 390².

—, 4(and 5) - chloro - 1 - methyl-, 390².

—, 5 - cyano - 1 - *p* - cyanoanilino-†, and hexabromide-HBr, 2973^a.

—, 1 - diacetylamino - 5 - ethoxy-, 2245².

—, 1,2-dihydro-. See *Benzothiazoline*.

—, 4,5 - dimethoxy - 1 - methyl-, 3467^a.

—, 3,5 - dimethyl - 1 - methylamino-, and derivs., 3705^a.

—, 1-ethyl-, and picrate, 142².

—, 5 - fluoro - 1 - *p* - fluoroanilino-, and dibromide-HBr, 2973^a.

—, 1 - heptylamino - 3 - methyl-, and derivs., 835^a.

—, 5-iodo-1-*p*-iodoanilino-, 2973^a.

—, 1-mercapto-, and derivs., P 4952¹.
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—, 5 - methoxy - 1 - *p* - methoxyanilino-, dibromo deriv., 2973^a.

—, 5-methoxy-1-methyl-, and picrate, 390^a.

—, 1-methyl-, derivs., prepn. of, 1900^a.
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—, 3 - methyl - 1 - methylamino-, and acetyl deriv., 835^a.

—, 3 - methyl - 1 - propylamino-, and derivs., 835^a &.

—, 5 - nitro - 1 - *p* - nitroanilino-, 2973^a.

—, 4-nitro-1-phenyl-, 3468^a.

—, 1-phenyl-, salts, 142².

—, 1-salicyl-†, 5184².

5 - Benzothiazolecarboxylic acid, 1 - *p* - carboxyanilino-, and derivs., 2973^a.

5 - Benzothiazolenitrile, 1 - *p* - cyanoanilino-, and hexabromide-HBr, 2973^a.

Benzothiazoline, 2 - acetyl - 1 - imino - 3,5 - dimethyl-, 3705^a.

—, 2 - acetyl - 1 - imino - 3 - methyl-, 835^a.

—, 5 - bromo - 2 - methyl - 1 - methylene-, 390^a.

—, 4(and 5) - chloro - 2 - methyl - 1 - methylene-, and carbon disulfide addn. compd., 390^a &.

—, 1-imino-2,3-dimethyl-, and acetyl deriv., 835^a.

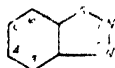
- , 1 - imino - 2,3,5 - trimethyl-, and derivs., 3705^a.
 —, 5 - methoxy - 2 - methyl - 1 - methyl-ene-, and carbon disulfide addn. compd., 390^a.

Benzothiazolium compounds, 2 - allyl-

- 1 - [γ - (2 - allyl - 1(2) - benzothiazylidene) - β - methylpropenyl] - bromide, 1903³.
 5 - bromo - 1 - [γ - [5 - bromo - 2 - methyl-1(2) - benzothiazylidene]propenyl] - 2 - methyl - iodide, 391¹.
 5-bromo-1,2-dimethyl— salts, 390^a.
 5 - chloro - 1 - [γ - [5 - chloro - 2,3 - dimethyl - 1(2) - benzothiazylidene]propenyl] - 2,3 - dimethyl - iodide, 391¹.
 4 (and 5) - chloro - 1 - [γ - [4 (and 5) - chloro-2 - methyl - 1(2) - benzothiazylidene]propenyl] - 2 - methyl - iodide, 390^a, 391¹.
 5 - chloro - 1 - (*p* - dimethylaminostyryl) - 2,3 - dimethyl— iodide, 390^a.
 4(?) - chloro - 1 - (*p* - dimethylaminostyryl) - 5 - methoxy - 2 - methyl - iodide, 390^a.
 5 - chloro - 1 - (*p* - dimethylaminostyryl) - 2-methyl— bromide, 390^a.
 4 - chloro - 1,2 - dimethyl— methylsulfate, 1900⁷.
 4 (and 5) - chloro - 1,2 - dimethyl - salts, 390^a.
 4(?) - chloro - 5 - methoxy - 1,2 - dimethyl - iodide, 390^a.
 5 - chloro - 1,2,3 - trimethyl - iodide, 390^a.
 1 - (*p* - dimethylaminostyryl) - 5 - methoxy-2-methyl— bromide, 390^a.
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 5 - ethoxy - 2 - ethyl - 1 - methyl - iodide, 1900⁷.
 2 - ethyl - 1 - [γ - (2 - ethyl - 1(2) - benzothiazylidene) - β - methylpropenyl]— iodide, 1903³.
 1-iodo-2-methyl— iodide, 389⁷.
 5-methoxy-1,2-dimethyl— salts, 390^a.
 4 - methoxy - 1 - [γ - [4 - methoxy - 2 - methyl-1(2) - benzothiazylidene]propenyl] - 2 - methyl— perchlorate, 391¹.
 2 - methyl - 1 - [β - methyl - γ - (2 - methyl-1(2) - benzothiazylidene)propenyl] - iodide, 1903³.
 2-methyl-1-phenyl— salts, 142^a.
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1(2)-Benzothiazolone, 2-methyl-, oxime, 389⁷.

Benzothiadiazole (diazosulfide; isopiazothiole; phenylenediazole),



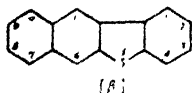
book, 4227^a.

—, 4,5-dimethoxy-, 3467^a.

Benzothiofuran. See *Thionaphthene*.

6,7 - Benzo - 1,3,4 - thioheptadiazine, 2-phenylhydrazino-, 139^a.

Benzothiophanthrene,



Benzo[β]thiophanthrene - 6,11 - dione, P 3583^a.
 hydroxy derivs., P 2570^a.

—, 2 - chloro - 7,10 - dihydroxy - 4-methyl-, P 5328^a.

—, 7,10-dihydroxy-, P 5328^a.

—, trihydroxy-, P 5328^a.

Benzothiophene. See *Thionaphthene*.

Benzothiopyran,



1,2-



1,4-

—, dihydro-. See *Thiochroman*.

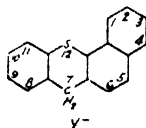
1,2-Benzothiopyran, 2-keto-. See *Thiocoumarin*.

1,4-Benzothiopyran, 4-keto-. See *Thiochromone*.

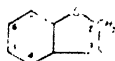
1,2-Benzothiopyrone. See *Thiocoumarin*.

1,4-Benzothiopyrone. See *Thiochromone*.

Benzothioxanthene,

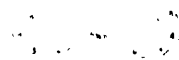


5,6,7-γ-Benzothioxanthetrione, 1901⁸.
Benzothiole,



2-Benzothioxolone, 5-methyl-, "nitrogen-free compd.", 2245⁷.

Benzotoluide,



m-Benzotoluide, *h*, 4'-dihydroxy-, dibenzoate, 1221.

o-Benzotoluide, oxidation by KMnO_4 at a $\text{CaH}_2\text{-H}_2\text{O}$ interface, 3618^a.

—, α - phenylcarbamyl - α - phenylimino-, 4469^a.

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1,2,4

—, 1,4 - dihydro - 3 - methylmercapto-, and - HCl , 380^a.

—, 3,3' - dithiois[1,4 - dihydro - 1 - phenyl-, 1390^a.

—, 1,2,3,4-tetrahydro-3-imino-, and derivs., 380^a.

1,2,4 - Benzotriazine - 2 - mercaptan, 1,4-dihydro-1-phenyl-, and acetyl derivs., 1398^a.

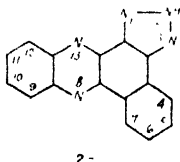
Benzotriazinone. See *Benzotriazinone*.

1,2,3-Benzotriazole (aximidobenzene; benzisotriazole),

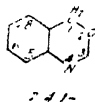


1,1,2 - Benzotriazole (pseudoaximidobenzene).
 —, 5-amino-2-(1 and 2)-naphthyl-, 830^a.

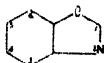
- , 2-(*p*-aminophenyl)-, 836⁶.
 —, 5-amino-2-phenyl-, 836⁶.
 —, 2-*p*-anisyl-, 836⁶.
 —, 2-(2,4-dihydroxyphenyl)-, 836⁶.
 —, 2-(*p*-dimethylaminophenyl)-, 836⁶.
 —, 2-[2 (and 4)-hydroxy-1-naphthyl]-, 836⁶.
 —, 2-(*p*-hydroxyphenyl)-, 836⁶.
 1,2,3-Benzotriazole-5-arsonic acid, 1-*p*-hydroxyphenyl-, 2954³.
 —, 1-phenyl-, 2954³.
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 2,1,3-Benzotriazole-2,2'-gallic acid, 836⁶.
 2,1,3-Benzotriazole-2,4'-1-naphthoic acid, 2'-hydroxy-, 836⁶.
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 2,1,3-Benzotriazole-2,5'-salicylaldehyde, 836⁶.
 2,1,3-Benzotriazole-2,5'-salicylic acid, 836⁶.
 2-Benzotriazolophenazine,



- , 2-*o*(*m* and *p*)-nitrophenyl-, 4217^{1,2}.
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 Benzoxanthene, isomers, 4702².
 2,4,1-Benzoxazine,

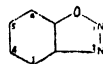


- , 1-keto-. See 2,4,1-Benzoxaz-1-one.
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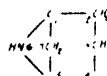
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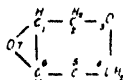
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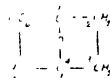
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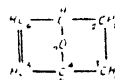
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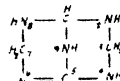
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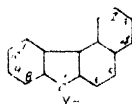
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α β γ

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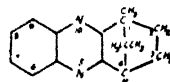
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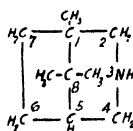
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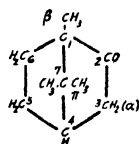
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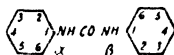
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β α

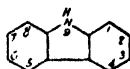
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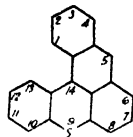
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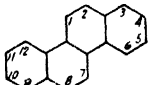
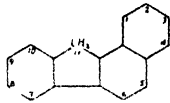
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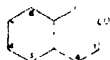
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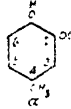
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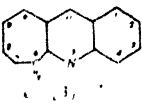
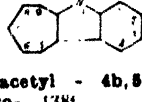
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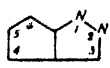
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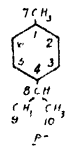
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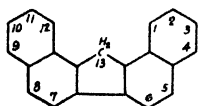
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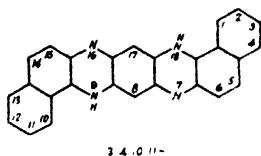
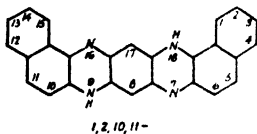
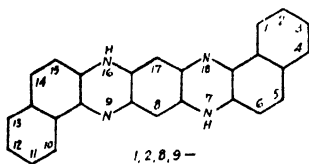
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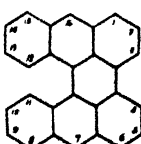
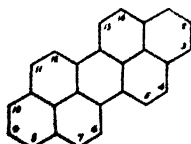
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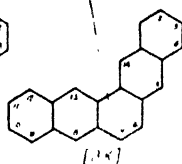
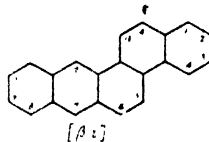
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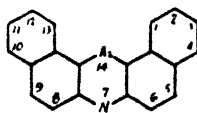
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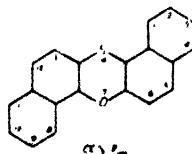
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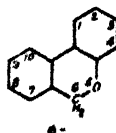
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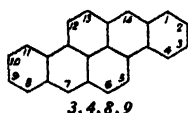
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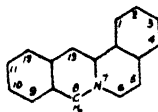
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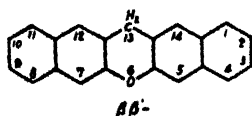
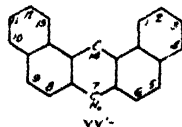
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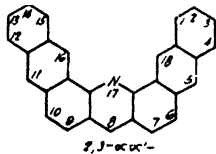
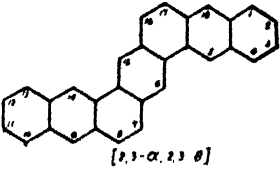
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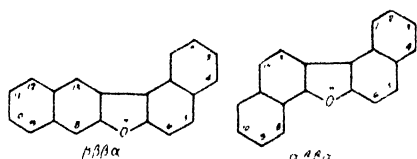
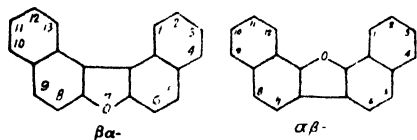
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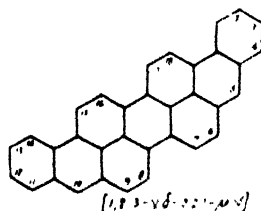
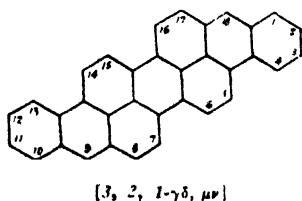
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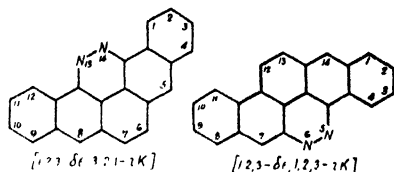
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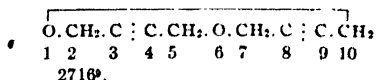
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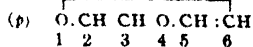
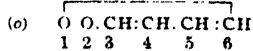
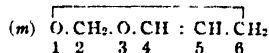
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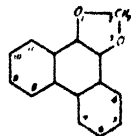


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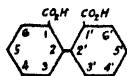
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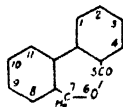
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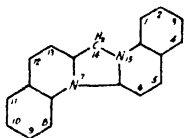
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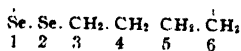
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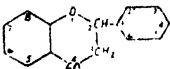
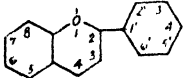
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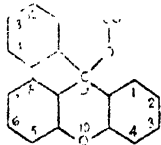
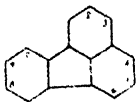
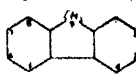
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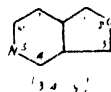
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—, β - bis [θ (and p) - nitrobenzoyl] -, 3665^o.

—, α - bromoacetyl - β - isobutyl - α - phenyl-, 145^o.

—, (3 - bromo - 4 - nitrophenyl)-, 3680^o.

—, α - (p - bromophenyl) - α - methyl - 1400^o.

—, carbonylbis-. See *Carbohydrazide*.

—, (carboxyisopropylidene)(4,5-dihydro-5 - keto - 3 - methyl - 1 - pyrazolyl-carbonyl)-, ethyl ester, 5164^o.

—, carvacryl-, and derivs., 5470^o.

—, α - cetyl - α - phenyl-, -HCl, prepn. of, 4214^o.

—, α - chloroacetyl - β - cinnamyl -, 2977^o.

—, α - *p* - chlorobenzoyl - β - *N* - *p* - chlorobenzoylanthranoyl-, 836^o.

—, β - (5 - chloro - 2,4 - dinitrophenyl)- α - methyl - α - phenyl-, oxidation of, 118^o.

—, (3 - chloro - 4 - nitrophenyl) -, and derivs., 4679^o.

—, (4 - chloro - 3 - nitrophenyl)-, 139^o.

—, (4 - chloro - 3 - nitrophenyl)-, 139^o.

—, α - (5 - chloro - 3 - nitro - *p* - tolylsulfonyl)- β -cinnamal-, 3665^o.

—, α , α - diacetyl - β - benzoyl-, 836^o.

—, α , α - diacetyl - β - 4 - chloroanthranoyl-, 828^o.

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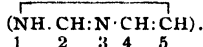
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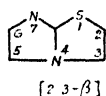
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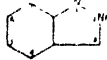
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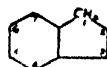
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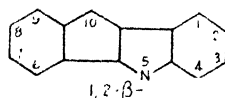
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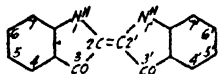
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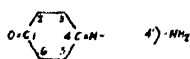
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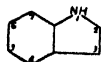
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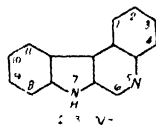
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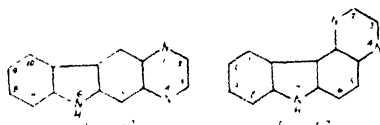
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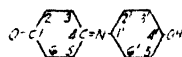
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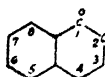
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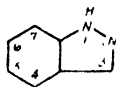
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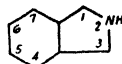
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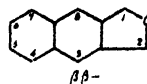
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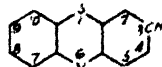
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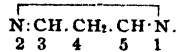
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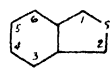
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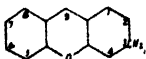
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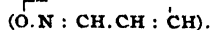
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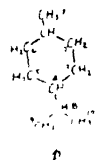
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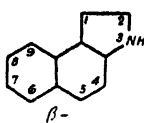
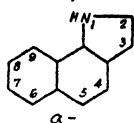
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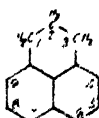
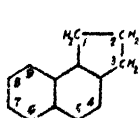
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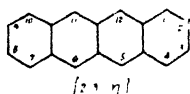
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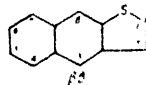
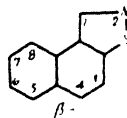
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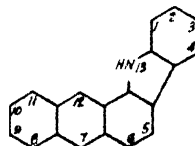
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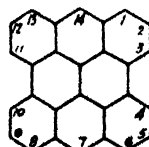
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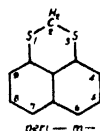
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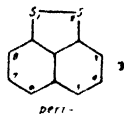
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—, **4-hydroxy-**, P 2190^o.

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—, **3-amino-5,6,7,8-tetrahydro-**, ethyl ester, P 154^o, P 2986^o.

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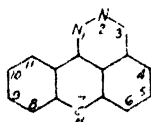
Naphtho-2',3':1,2-phenanthrene*, 4947¹.

Naphtho-2',3':2,3-phenanthrene*, 4947¹.

Naphthophenazineoxazine*, 1895².

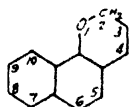
Naphthophenofluoridine, 6-acetylamino-phenyl-, 1895².

Naphthophthalazine,

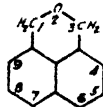


3,7(2) - Naphthophthalazinedione, 4-methyl-, 4696¹.

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1,2-OC-



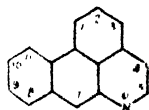
2,1,3-*peri*-

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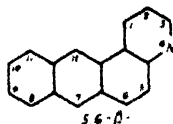
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5,6- β -

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—, N-chloro-4-ethoxy-, P 2190³.

—, 5-chloro-4-ethoxy-, P 2190³.

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1,6-Naphthosultam,



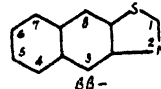
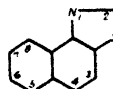
—, 3-anilino-, P 613⁴.

1,8 - Naphthosultam - 6 - sulfonic acid.

See "sultam" under 1,6-Naphthalenedisulfonic acid, 8-amino-.

Naphthosultone. See "sultone" under 1-Naphthol 8-sulfonic acid.

Naphthothiazole,

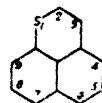


$\beta\beta$ -

β - Naphthothiazole, 2-amino-4-methoxy-, P 5328¹.

3,8 - $\beta\beta$ - Naphthothiazole, and derivs., P 4950⁴.

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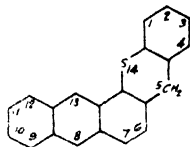
2-*peri*-Naphthothiopyranol, P 1418², P 3933⁴.
 —, bromo-, P 1418².

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—, **bromo-**, P 2723³.

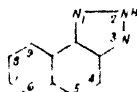
Naphthothioxanthene,



4,5 - γ - Naphthothioxanthene - 5,8,13-trione, 7-amino-, 2-halo derivs., dyes from, P 4081¹.

3,4 - Naphthothioxanthone - 1,2 - quinone*, 1901³.

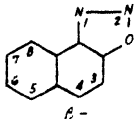
α, β -Naphthotriazole,



4,5 - $\alpha\beta$ - Naphthotriazoledione, 2 - o(m and p)-nitrophenyl-, 4216⁷, 4217¹.

5 - $\alpha\beta$ - Naphthotriazolol, 2 - o(m and p) - nitrophenyl - 4 - phenylazo-, 4216⁷, 4217^{1,2}.

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—, **N,N-dimethyl-4(and 5)-nitro-**, 4466⁹.

—, **N-ethyltetrahydro-**, P 2987⁴.

—, **N-methyl-4(and 5)-nitro-**, 4466⁹.

—, **8-nitro-**, 3697⁴.

—, **N-phenyl-**, tetrabromo deriv., 3709³.

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—, **N - (e - p - anisyl - $\Delta^{2,4}$ - pentadienyldene)-**, 3912¹.

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—, **N-benzyl-1-phenylazo-**, copper deriv., 386³.

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—, **1-chloro-**, manuf. of, P 2986¹.

—, **1-chloro-N,N-dimethyl-**, P 606².

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—, **N,N-dimethyl-7,7-dinitro-**, 4467¹.

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—, **N-ethyltetrahydro-**, P 3717⁴.

—, **3-methoxy-**, 833⁴.

—, **3(and 6)-methoxy-**, P 2188^{4,5}.

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—, **N-methyl-6-nitro-**, and picrate, 4466⁹.

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—, **phenylazo-**, copper deriv., 386⁴.

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—, **3-phenyl-, d-, and l-**, and dicamphor sulfonates, 4693⁹.

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—, **4-nitro-**, K salt, 2160⁹.

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
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
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$$\begin{array}{ccccccc} \text{O} & \text{CH}_2 & \text{CH}_2 & \text{NH} & \text{CH}_2 & \text{CH}_2 \\ 1 & 2 & 3 & 4 & 5 & 6 \end{array}$$

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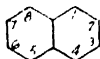
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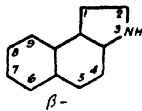
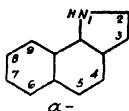
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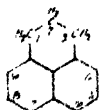
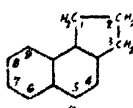
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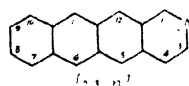


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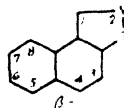


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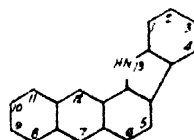
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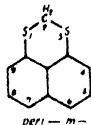
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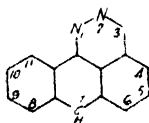
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Naphtho-2',3':2,3-phenanthrene*, 4947¹.

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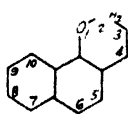
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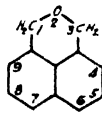


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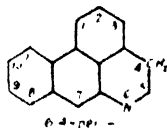
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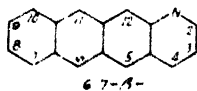
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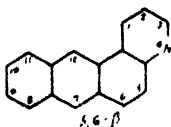
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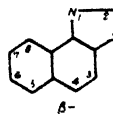
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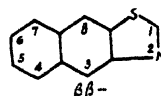
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6- α -

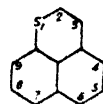


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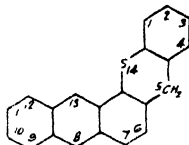
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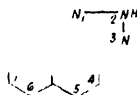
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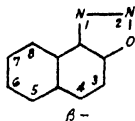
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
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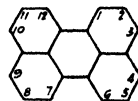
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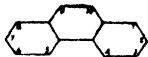
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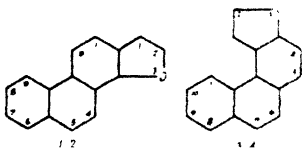
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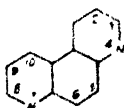
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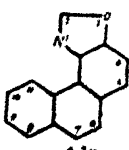
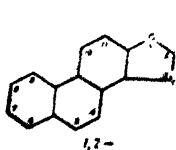
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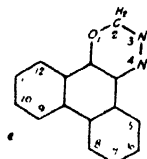


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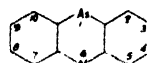
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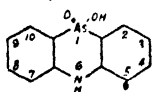
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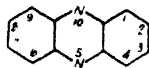
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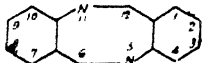
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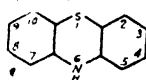
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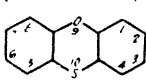
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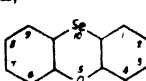


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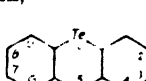
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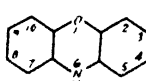
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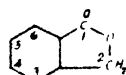
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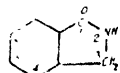
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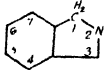
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

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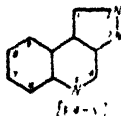
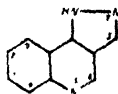
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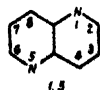
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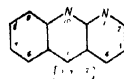
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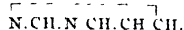
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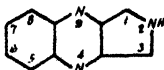
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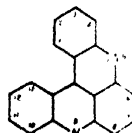
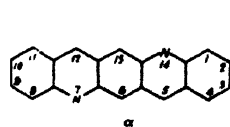
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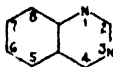
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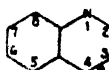
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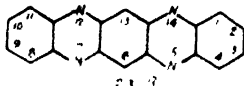
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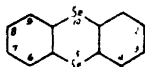
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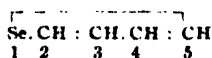
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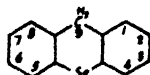
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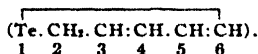
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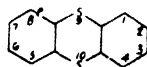
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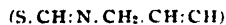
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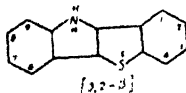
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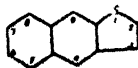
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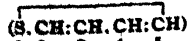
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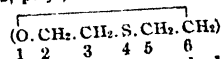
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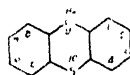
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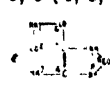
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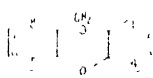
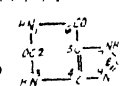
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
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- Zinc selenide**, fluorescent, prepn. of, 5110^o.
- Zinc silicate**. See *Willemit*.
- Zinc sodium sulfate**, 1343^o, 3149^o, 4616^o.

extg. extracting	p. p. m. parts per million
extn. extraction	ppt. precipitate
f. p. freezing point	pptd. precipitated
ft. foot, feet	pptg. precipitating
g. gram(s)	pptn. precipitation
h. p. horsepower	Pr propyl
hr. hour	prep. prepare
in. inch(es)	prepd. prepared
inorg. inorganic	prtpg. preparing
insol. insoluble	prepn. preparation
kg. kilogram(s)	qual. qualitative
kw. kilowatt(s)	quant. quantitative
l. liter(s)	recrystd. recrystallized
lab. laboratory	resp. respectively
lb. pound(s)	r. p. m. revolutions per minute
m. meter(s); also (followed by a figure denoting temperature) melts at, melt- ing at	sapon. saponification
manuf. manufacture	sapond. saponified
math. mathematical	sapong. saponifying
max. maximum	sat. saturate
Me methyl (MeOH, methanol)	satd. saturated
mech. mechanical	satg. saturating
mfg. manufacturing	satn. saturation
mg. milligram	sec. second(s)
min. minimum (also minute(s))	sep. separate
mixt. mixture	sepd. separated
mol. molecule, molecular	sepg. separating
mol. wt. molecular weight	sepn. separation
m. p. melting point	sol. soluble
n index of refraction (n_D^{20} , for 20° and sodium light)	soln. solution
N normal	soly. solubility
neg. negative	sp. specific
no. number	sp. gr. specific gravity
org. organic	sq. cm. square centimeter(s)
p. d. potential difference	sym. symmetrical
pharmacol. pharmacological	temp. temperature
phys. physical	U. S. P. United States Pharmacopeia
physiol. physiological	v. volt(s)
pos. positive	vol. volume (not volatile)
powd. powdered	w. watt(s)
	w. p. c. watts per candle
	wt. weight

III. FORMULA INDEX

KEY

In using this index the following should be borne in mind:

1. The Formula Index is **supplementary** to the Subject Index; in no sense does it replace any part of the latter except that most of the organic compounds that were not named in the original papers are entered in the former only.

2. **Inorganic as well as organic compounds** have been entered.

3. **Entries under their own formulas** are made for all strictly inorganic and strictly organic compounds and for the true organic derivatives of organic compounds, both addition compounds and true reaction derivatives (this includes esters, hydrazones, methohalides, oximes, picrates, semicarbazones, etc.). Inorganic salts of organic acids and inorganic addition compounds of organic compounds (hydrohalides, chloroplatinates, perchlorates, sulfates, etc.) are not given separate entries but are indicated in modifying phrases under the formulas of the compounds from which they are derived (under the acid in the case of a salt). Salts of formic, acetic and oxalic acids are exceptions; these are entered as such.

4. The **arrangement of symbols in formulas** is alphabetical except that in carbon compounds C always comes first, followed immediately by H if hydrogen is also present.

5. The **arrangement of formulas** is also alphabetical except that the number of atoms of any specific kind influences the order of compounds; e. g., all formulas with 1 C come before those with C₂, thus: CCl₂O, CCl₄, CHCl₃, CHN, CHNO, CH₂Br₂, CH₂O, CH₃Cl, CO, C₂Ca, C₂H₄O₂.

6. The **arrangement of entries under any heading** is strictly alphabetical according to the preferred names of the isomers.

7. **Entries consist of** (a) the formula (in bold-face type), (b) the name as it has been entered in the Subject Index (in light-face Roman type; *it should be noted particularly that the part of the entry in this type is the exact equivalent of the formula given*), (c) occasionally a modifying phrase or word such as "Ca salt" or "hydrochloride" (in italics, different type being used to set off that part of a compound being indexed which is not represented in the formula used; see ¶ 3 above), (d) the page reference and (e) the fraction of the page in ninths (indicated by a small superior numeral) in which the compound will be found.

8. **Cross-references** are to the Subject Index.

9. **Water of hydration** is not made a part of the formulas indexed but is usually given in light-face type following the formulas.

10. **Polymers** having different names and recognized as different substances, *e. g.*, acetaldehyde and paraldehyde, are all entered under their accepted formulas. But definite compounds for which different polymeric formulas are in use are entered under the simplest formula only with cross-references under the polymeric formulas.

11. A **straight line**, thus ---, used under some headings to avoid repetition of names, always stands for the name of the "index compound," *i. e.*, that part of the preceding name (inverted) which comes before the comma.

12. "P" before a page number indicates that the abstract is of a patent.

13. The names **beryllium** (Be), **columbium** (Cb) and **hafnium** (Hf) are given preference over glucinum (Gl), niobium (Nb) and celtium (Ce), respectively, for these elements.

The Key to a formula index is necessarily lengthy. It would not be correct to conclude from this that this index is difficult to use. Experience is to the contrary.

INTRODUCTION

General purpose and policy. The location of chemical compounds in an index by names is at times uncertain because names vary and in the case of complex compounds may be difficult to ascertain. New compounds are constantly being prepared, which if named at all, may receive more than one name which is justified from one point of view or another and the possibilities of incorrect names are great. Since the kind and number of component atoms of a chemical compound are unvarying characteristics the supplementary Formula Index to *Chemical Abstracts* is published for the purpose of eliminating this element of uncertainty in the Subject Index. Except that many unnamed compounds are no longer entered under the heading "Compound," the Subject Index is in no way altered on account of the Formula Index. In the Subject Index related compounds are grouped rather effectively and to good use by the present system of indexing on the basis of "parent compounds" or more accurately "index compounds"; in the Formula Index the certain location of individual compounds is the primary consideration. The Subject Index is more convenient to use in some respects and it frequently contains more information in the form of modifying phrases. The repetition of modifying phrases in the Formula Index beyond necessary brief phrases to indicate derivatives has been avoided as unnecessary for the accomplishment of the real purpose of this index, as stated above, and as inconsistent with necessary economy. Isomerism is not indicated in the Formula Index in cases in which the name differs only in position numbers or letters but it always is in the Subject Index when known. Ready reference to the Subject Index for the purpose of locating information regarding related compounds is made possible by the use in the Formula Index of names following the formulas written exactly as they appear in the former index.

All new compounds and all compounds for which new data are given have been entered. Most of the compounds have been entered under their own formulas. Some departure from a policy of making separate formula entries for derivatives of all kinds is reasonable and accords with custom. The only departures in this index are:

of the Key) have been in classes of compounds the natures of which would be more than likely apparent to the investigator. The interest in a salt of a complex organic acid, for example, is likely to be mainly in the acid and it is considered more valuable to have the record of it under the formula of the acid for the use of searchers looking up that acid.

In the case of unnamed organic compounds where possible the class, as acid, source and melting or boiling point have been given.

Cross-references to the Subject Index have been used for all simple inorganic compounds, for all minerals of definite composition and for the organic compounds more commonly met with, in general whenever it seemed likely that users of *Chemical Abstracts* would predominately refer to the Subject Index.

The system. The system, as described in the Key, is, with slight modifications, that worked out by Dr. Edwin A. Hill,¹ and used by the Classification Division of the U. S. Patent Office. This system is preferred to the system of Richter's Lexikon because of its greater simplicity and its applicability with equal fitness to inorganic as well as to organic compounds.

AgBr See *Silver bromide*.

AgCl See *Silver chloride*.

AgClO₃ See *Silver chlorate*.

AgClO₄ See *Silver perchlorate*.

Ag₂CN₂O₈, 1342².

AgF See *Silver fluoride*.

Ag₂H₂NO₈, Ammonium silver thio sulfate, 1076³.

Ag₂H₂JN₂ + H₂O, 5429¹.

Ag₂H₂N₂O, 1361¹.

AgI See *Silver iodide*.

Ag₂KO₈, Potassium silver thiosulfate, 1076³.

Ag₂K₂O₈ + H₂O Potassium silver thiosulfate, 1076³.

AgNO₂ See *Silver nitrite*.

AgNO₃ See *Silver nitrate*.

Ag₂NaO₈ Sodium silver sulfite, 4610¹.

Ag₂Na₂O₈, Sodium silver thiosulfate, 1076³, 3747⁴.

Ag₂O₂ See *Silver peroxide*, 4632⁴.

Ag₂O₂V Silver pervanadate, 1725⁴.

Ag₂Br₂O₈, 575⁴.

Ag₂CrO₄ See *Silver chromate*.

Ag₂Cr₂O₇ See *Silver dichromate*.

Ag₂F See *Silver fluorides*.

Ag₂FO₂P Silver fluophosphate, 4903⁴.

Ag₂O See *Silver oxides*.

Ag₂O₂ See *Silver sulfate*.

Ag₂S See *Argentite*; *Silver sulfide*.

Ag₂Se See *Silver selenide*.

Ag₂Te See *Silver telluride*.

Ag₂As₂ See *Proustite*.

Ag₂As₂S₂ See *Xanthoconite*.

Ag₂Br₂H₂O₂P, 575⁴.

Ag₂Cl₂H₂O₂P, 575⁴.

Ag₂Ca₂N₂O₁₁, 1342².

Ag₂H₂N₂O₈, Ammonium silver thiosulfate, 1076³.

Ag₂K₂O₈, Potassium silver thiosulfate, 1076³.

Ag₂Na₂O₈ + 3H₂O Sodium silver thiosulfate, 1076³.

Ag₂O₂V See *Silver vanadate*.

Ag₂Sb₂ (See also *Pyroargyrite*.) 2393¹.

Ag₂Sb See *Dyscrasite*; *Silver antimonide*.

Ag₂Sn, 1844², 2082².

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Ag₂(Al₂Ca₂Na₂O₇)₂Si₂, 2336¹.

Ag₂(Al₂CaO₇)₂Si₂, 2336¹.

Ag₂(Al₂Na₂O₇)₂Si₂, 2336¹.

Ag₂(Al₂O₇)₂Si₂Br, 2336¹.

Ag₂Sn See *Silver stannide*.

Ag₂S₂Sb₂, 2393¹.

Ag₂Al₂O₇Si₂Si₂, 2336¹.

AlAs Aluminum arsenide, 785².

AlBeHO₂Si See *Enclase*.

AlBr₃ See *Aluminum bromide*.

AlCl₃ See *Aluminum chloride*.

AlCl₃O₂, Aluminum perchlorate, 5388¹.

AlCa₂O₇Si₂ + 12H₂O See *Alums*.

AlCu, 1095², 5138¹.

AlF₃ See *Aluminum fluoride*.

AlF₃Na₂ See *Crvoite*.

AlH See *Aluminum hydride*.

AlHO See *Diaspore*; *Tanalarze*.

AlHO₂Si See *Pyrophyllite*.

AlH₂NaO₂, Sodium aluminate, 3840¹.

AlH₂O See *Aluminum hydroxide*, *Gibbsite*.

AlH₂NO₂Si₂ + 12H₂O See *Alum⁹*.

AlI₃ See *Aluminum iodide*.

AlKO₂Si See *Leucite*.

AlKO₂Si₂ + 12H₂O See *Alums*.

AlLiO₂Si See *Spodumene*.

AlLiO₂, Lithium aluminate, 4418¹.

AlN See *Aluminum nitride*.

AlN₂O See *Aluminum nitrate*.

AlNaO See *Sodium aluminate*.

AlNaO₂Si₂ See *Analcite*; *Jadeite*.

AlNaO₂Si₂ See *Aluminum sodium sulfate*.

AlNaO₂Si See *Albite*.

AlO₂P See *Aluminum phosphate*.

AlO₂Rb₂Si₂ + 12H₂O See *Alums*.

AlP Aluminum phosphide, 2862⁴.

AlSb, 1095².

Al₂Be₂O₇ Barium aluminate, 245², 1223¹.

Al₂Be₂F₂K₂O₇Si₂ + 24H₂O, 2115¹.

Al₂BeO₄ See *Chrysoberyl*.

Al₂Be₂O₇Si₂ See *Beryl*.

Al₂Ca₂H₂O₇Si₂ See *Laumontite*; *Leonhardite*.

Al₂CaO₂, Calcium aluminate, 2382¹.

Al₂CaO₂Si₂ See *Anorthite*.

Al₂CaO₂Si₂ + 3H₂O See *Scolerite*.

Al₂Ca₂O₇, Calcium aluminate, 2382¹, 4418¹, 4870¹.

Al₂Ca₂O₇Si₂ See *Gehlenite*.

Al₂Ca₂O₇Si₂ See *Genesite*; *Grossularite*.

Al₂Ca₂O₇Si₂ + 12H₂O Calcium sulfoaluminate, 3181¹.

Al₂Ca₂O₇Si₂, Calcium sulfoaluminate, 3554¹.

Al₂Ca₂O₇Si₂, Calcium sulfoaluminate, 3180¹, 3551¹.

¹ *J. Am. Chem. Soc.*, **22**, 478-94 (1900).

- CCoO_2 See Cobalt carbonate.
 CCuNa_2O_2 , 1362.
 CCuO_2 See Copper carbonates.
 CFeO_2 See Siderite.
 CFe_2 See Cementite.
 CFe_2W_2 , 80.
 CHBrN , 1, 2, 3, 4-Tetrazole, 5-bromo-, 4471.
 CHBr_2 See Bromoform.
 CHBr_2NTi Addn. compd. of HCN and TiBr₄, 3868.
 CHClN , 1, 2, 3, 4-Tetrazole, 5-chloro-, 4471.
 CHCl_2 See Chloroform.
 CHIN , 1, 2, 3, 4-Tetrazole, 5-iodo-, 4471.
 CHI See Iodoform.
 CHLiS , Iodoform, compd. with S, 1614.
 CHLiO , Lithium formate, 1541.
 CHN See Hydrocyanic acid.
 CHNO See Cyanic acid.
 CHNaS , Formic acid, dithiotriazo-, 4200.
 CHNaO_2 See Sodium formate.
 CHNaO_2 See Sodium carbonates.
 CHOTi See Thallium formate.
 CH_2Br_2 See Methane, dibromo-.
 CH_2CaO_2 , 763.
 CH_2Cl_2 See Methane, dichloro-.
 $\text{CH}_2\text{Cl}_2\text{O}_2\text{S}$ Chlorosulfonic acid, chloromethyl ester, P 2990.
 $\text{CH}_2\text{Cu}_2\text{O}_2$ See Malachite.
 CH_2I_2 See Methane, diiodo-.
 CH_2N_2 See Cyanamide; Methane, diazo-.
 $\text{CH}_2\text{N}_2\text{Na}_2\text{O}$ Urea, di-Na deriv., P 1418.
 $\text{CH}_2\text{N}_2\text{Na}_2\text{O}_2$ Methane, bis(nitrosobydroxamino)-, di-Na deriv., 1385.
 CH_2NO , 1, 2, 3, 4-Tetrazol-5-ol, 4471.
 CH_2O See Formic acid.
 CH_2O_2 See Carbonic acid.
 CH_2S , Formic acid, dithio-, and salts, 3438.
 CH_2S_2 , Carbonic acid, trithio-, 572.
 CH_2 Methyl, 5159.
 CH_2AsCl_2 Arsine, dichloromethyl-, 3874, 4442.
 CH_2Br See Methane, bromo-.
 CH_2BrHg Methane, (bromomercuri)-, 1870.
 CH_2BrO_2 , Methionic acid, bromo-, and salts, 4445.
 CH_2BrSn Stannane, tribromomethyl-, 2931.
 CH_2BrTe Methyltellurium tribromide, 2934.
 CH_2Cl See Methane, chloro-.
 CH_2ClHg Methane, (chloromercuri)-, 1870.
 CH_2ClSn Stannane, trichloromethyl-, 2931.
 CH_2F See Methane, fluoro-.
 CH_2HgI Methane, (iodomercuri)-, 1870.
 CH_2HgNO_2 Methane, (hydroxymercuri)-, nitrate, 1871.
 CHI See Methane, iodo-.
 CHI_2Te Methyltellurium triiodide, 2933.
 CHNO Formamide, 21, P 2191, P 3239.
 CHNO_2 Carbamic acid, NH₂ salt, 8053.
 CHNO_2 Methane, nitro-, 1331, 3429, 3628, 4459.
 CHNNaO Urea, Na deriv., P 1418.
 CHN , Methane, triazo-, 4617.
 CHNNaS Guanidine, di-Na deriv., P 1418.
 CHN_2O_2 Urea, nitro-, 8442.
 CHN_2 , 1, 2, 3, 4-Tetrazole, 5-amino-, and salts, 4471.
 CHNaO See Sodium methoxide.
 CH See Methane.
 CHBrHgO , 1556.
 CHClHgNa , 2344.
 CHHgO Methane, (hydroxymercuri)-, 1870.
 CHNaO See Urea.
 CHNaS (See also Ammonium thiocyanate; Urea, thio-.)
 Pseudourea, thio- , 1116.
 CHNaS Guanidine, Na deriv., P 1418.
 $\text{CH}_2\text{N}_2\text{O}_2$ Guanidine, nitro-, 1404.
 CH_2O See Methanol.
 $\text{CH}_2\text{O}_2\text{S}$ Methanesulfonic acid, 1 salt, 1835.
 CH_2O_2 Methionic acid, 5161.
 CH_2BrLiN Addn. compd. from LiBr and MeNH₂, 2118.
 CH_2ClLiN Addn. compd. from LiCl and MeNH₂, 2118.
 CH_2ILiN Addn. compd. from LiI and MeNH₂, 2118.
 CH_2N See Methylamine.
 CH_2NO_2 Ammonium formate, P 3238.
 CH_2NO_2 See Ammonium carbonates.
 CH_2N_2 See Guanidine.
 $\text{CH}_2\text{N}_2\text{O}$ See Semicarbaside.
 $\text{CH}_2\text{N}_2\text{S}$ See Semicarbaside, thio-.
 $\text{CH}_2\text{N}_2\text{S}_2\text{V}$ + 2H₂O, 1586.
 $\text{CH}_2\text{N}_2\text{O}_2$ Guanidine, aminonitro-, 1404.
 $\text{CH}_2\text{AlNO}_2\text{S}_2$ + 12H₂O Methyl ammonium alum, 2864.
 $\text{CH}_2\text{Be}_2\text{O}_2$ + nH₂O, 351.
 $\text{CH}_2\text{CrNO}_2\text{S}_2$ + 12H₂O See Alums.
 CH_2N Guanidine, amino-, 4973.
 $\text{CH}_2\text{N}_2\text{S}$ Ammonium thiocarbonate, 572.
 $\text{CH}_2\text{N}_2\text{S}_2$ Ammonium perthiocarbonate, 572.
 $\text{CH}_2\text{Br}_2\text{CrNaS}$, 351.
 $\text{CH}_2\text{ClCoN}_2\text{O}_2$ + H₂O, 1076.
 $\text{CH}_2\text{CrLiNaS}$, 350.
 $\text{CH}_2\text{CrN}_2\text{O}_2\text{S}$, 351.
 $\text{CH}_2\text{CoNaO}_2\text{S}_2$ + 4H₂O, 1076.
 CH_2IKN , 2344.
 CIN See Cyanogen iodide.
 CLiO_2 Lithium potassium carbonate, 5127.
 CKN See Potassium cyanide.
 CKNO See Potassium cyanate.
 CKNS See Potassium thiocyanate.
 CKO_2 See Potassium carbonates.
 CLiNaO_2 Lithium sodium carbonate, 5127.
 CLiO_2 See Lithium carbonate.
 CMgN See Magnesium cyanamide.
 CMgO_2 See Magnesite, Magnesium carbonate, Nesquehonte.
 CMnO_2 See Manganes carbonate; Rhodochrosite.
 CMNa See Sodium cyanide.
 CMNaS See Sodium thiocyanate.
 CN_2O_2 Methane, tetranitro-, 5077.
 CN_2O_2 See Sodium carbonate.
 CNiO_2 See Nickel carbonate.
 CNi Nickel carbide, 1109.
 CO See Carbon monoxide.
 COS Carbonyl sulfide, 1027, 4113.
 CO_2 See Carbon dioxide.
 CO_2Pb See Cerussite; Lead carbonate.
 CO_2Sr See Strontianite; Strontium carbonate.
 CO_2Zn See Smithsonite; Zinc carbonate.
 CS_2 Carbon disulfide, 3180, 5129.
 CS See Carbon disulfide.
 CV , Vanadium carbide, 3888.
 CW See Tungsten carbides.
 $\text{C}_2\text{AgHgW}_2\text{O}_2$ + 2H₂O, 4016.
 C_2Ba See Barium carbide.
 C_2BeO_2 See Beryllium oxalate.
 C_2BrCuN , 1, 2, 3, 4-Tetrazole, 5-bromo deriv., 4471.
 C_2Br_2 Ethylene, tetrabromo-, 1614.
 $\text{C}_2\text{BrN}_2\text{Ti}$ Addn. compd. of BrCN and TiBr₄, 2868.
 $\text{C}_2\text{Br}_2\text{S}_2$, 5187.
 C_2Ca See Calcium carbide.
 $\text{C}_2\text{CaO}_2\text{HgNa}$, 2344.
 $\text{C}_2\text{CaK}_2\text{O}_2$ Calcium potassium carbonate, 5127.
 C_2CaN_2 See Calcium cyanide.
 $\text{C}_2\text{CaNa}_2\text{O}_2$ Calcium sodium carbonate, 5127.

- C_2CaO_4 See *Calcium oxalate*.
 $C_2Cl_4CuN_4$ 1,2,3,4-Tetrazole, 5-chloro-, Cu deriv., 4471⁴.
 $C_2Cl_4HgMgN_4$, 2344².
 $C_2Cl_4HgN_4Sr$, 2344².
 C_2Cl_4O Oxalyl chloride, 1130¹.
 C_2Cl_4 See *Ethylene, tetrachloro-*.
 $C_2CoK_2O_6$ Cobalt potassium carbonate, 1563¹, 4156².
 $C_2CoN_2S_2$ See *Cobalt thiocyanate*.
 $C_2CuK_2O_6 + 4H_2O$, 1362⁴.
 C_2CuN_4 See *Copper cyanide*.
 $C_2CuN_2S_2$ Copper thiocyanate, 3048¹.
 $C_2CuNa_2O_6$, 1362⁴.
 C_2HBrMg Ethynylmagnesium bromide, 90².
 C_2HBrO Bromal, 3141².
 C_2HBrO_2 See *Acetic acid, tribromo-*.
 C_2HCl See *Ethylene, trichloro-*.
 C_2HClO See *Chloral*.
 C_2HClO_2 See *Acetic acid, trichloro-*.
 C_2HCl_4 Ethane, pentachloro-, 3101⁴.
 C_2HI Acetylene, iodo-, 2930².
 $C_2HK_2NaO_4 + 2H_2O$ Potassium sodium carbonate, 4126⁴.
 $C_2HNO_2S_2$ 1,3,4-Dithiazole - 2,5(-4) - dione, 2953².
 C_2H_2 See *Acetylene*.
 $C_2H_3AsCl_2$ Arsine, dichloro(β -chlorovinyl)-, 91¹, 3874⁴.
 $C_2H_2BaO_4$ Barium formate, 1541², 2863².
 C_2H_2Br See *Ethylene, dibromo-*.
 $C_2H_2Br_4$ Ethane, tetrabromo-, 1598², 3977².
 C_2H_2BrNTl Addn. compd. of HCN and TlBr, 3868².
 $C_2H_2CaO_4$ Calcium formate, 1541².
 $C_2H_2CaO_6$ See *Calcium carbonates*.
 $C_2H_2Cl_2$ See *Ethylene, dichloro-*.
 $C_2H_2Cl_2O$ Acetaldehyde, dichloro-, 2975¹, 4218⁴.
 $C_2H_2Cl_2O_2$ See *Acetic acid, dichloro-*.
 $C_2H_2Cl_4$ See *Ethane, tetrachloro-*.
 $C_2H_2Cl_5S$ Ethanesulfenyl chloride, trichloro-, 2933⁴.
 $C_2H_2Cu_2O_4$ See *Azurite*.
 $C_2H_2I_2$ Ethylene, *s*-diiodo-, 1614².
 $C_2H_2N_2O_2$ (See also *Mercury fulminate*.) Dicyanic acid, 3442¹, 3.
 $C_2H_2N_2O_2S_2$ 1,3,4-Thiodiazole-2,5-dione, 3,4-di hydro-, 1398⁴.
 C_2H_2O Ketene, P 1142², P 4485².
 $C_2H_2O_2$ See *Glyoxal*.
 $C_2H_2O_4$ See *Oxalic acid*.
 $C_2H_2O_4Pb$ See *Lead formate*.
 $C_2H_2O_4Sr$ See *Strontium formate*.
 $C_2H_2O_4U + H_2O$ Uranyl formate, 5302².
 $C_2H_2O_4Pb_2S_2$ See *Lead sulfate*.
 $C_2H_2BiO_4$ Basic bismuth acetate, 2117⁴.
 C_2H_2BrO (See also *Acetyl bromide*.) Acetaldehyde, bromo-, 4218⁴.
 $C_2H_2BrO_2$ See *Acetic acid, bromo-*.
 $C_2H_2BrO_2S_2$ Methionic acid, aldehydobromo-, and salts, 3209², 3.
 C_2H_2BrO (See also *Averitin*.) Ethanol, 2-tribromo-, P 851², 1217¹, P 4951².
 $C_2H_2BrO_2$ Bromal hydrate, 3021⁴.
 C_2H_2Cl See *Ethylene, chloro-*.
 $C_2H_2ClHgO_2$ Acetoxymercuric chloride, 4442².
 C_2H_2ClO (See also *Acetyl chloride*.) Acetaldehyde, chloro-, P 3235², P 3479², 4218⁴.
 $C_2H_2ClO_2$ See *Acetic acid, chloro-*.
 $C_2H_2Cl_4$ Ethane, trichloro-, P 2724¹, P 3931⁴, 5467².
 $C_2H_2Cl_5O$ Ethanol, 2-trichloro-, P 853¹.
 $C_2H_2Cl_2O$ See *Chloral hydrate*.
 C_2H_2HgN Methane, (cyanomercuri), 1871¹.
 $C_2H_2KO_2$ See *Potassium acetate*.
 C_2H_2N See *Acetonitrile*.
 C_2H_2NO Isocyanic acid, Me ester, 2698².
 $C_2H_2N_2Ni$ Nickel cyanide, compd with NH_3 , 2418².
 $C_2H_2N_2OS$ 1,3,4-Thiodiazolid-2-one, 5-imino-, 2974².
 $C_2H_2NaO_2$ See *Sodium acetate*.
 $C_2H_2Na_2O_2S_2$ Acid sodium sulfate oxalate, 1075⁴.
 $C_2H_2O_2Ti$ See *Titanium acetate*.
 C_2H_2 See *Ethylene*.
 $C_2H_2AsCl_2$ Arsine, dichloro(β -chloroethyl), 91¹, 2158².
 $C_2H_2I_2$ See *Ethane, dibromo-*.
 $C_2H_2Cl_2$ See *Ethane, dichloro*.
 $C_2H_2Cl_2O$ Ether, bis(chloromethyl), P 2990⁴.
 $C_2H_2Cl_2OS_2$ Ethanol, 2-chloro-, chlorosulfonate, 1107¹.
 $C_2H_2Cl_2OS_2$ Carbinol, chloro-, sulfate, P 2990⁴.
 $C_2H_2Cl_2OP$ Ethylphosphoryl dichloride, β -chloro-, 1874².
 $C_2H_2I_2$ See *Ethane, diiodo-*.
 C_2H_2NNaO Acetamide, Na deriv., P 1418².
 $C_2H_2NO_2Sc$, 2698².
 $C_2H_2NO_2$ Oxamide, 2941².
 $C_2H_2NO_2$ Acetonitric acid, α -hydroxy-, 816⁴.
 $C_2H_2NO_2$ Ethylene nitrate, 3346⁴, P 3346², 3809², 4073², 4074¹, 2.
 $C_2H_2N_4$ See *Guanidine, cyano-*.
 $C_2H_2N_4O$ Buret, 1-nitro-, 3442².
 C_2H_2O See *Acetaldehyde; Ethylene oxide; Vinyl alcohol*.
 C_2H_2OS Acetic acid, thio-, Sr salt, 5241².
 $C_2H_2O_2$ (See also *Acetic acid; "methyl ester" under Formic acid*.) Glycolaldehyde, 3902¹, 4716².
 $C_2H_2O_2$ (See also *Glycolic acid*.) Peracetic acid, 2702².
 $C_2H_2O_2S_2$ Methionic acid, aldehyde-, and derivatives, 3209², 3.
 $C_2H_2AsCl_2$ Arsine, dichloroethyl-, 2158², 3874⁴.
 $C_2H_2AsCl_2O$ Ethanol, 2-dichloroarsyl-, 91², 2158².
 $C_2H_2AsO_2$ Ethanol, 2-arsinoso-, 91².
 $C_2H_2AsO_2$ Acetic acid, arsono-, 595², 2429².
 C_2H_2Br See *Ethane, bromo-*.
 C_2H_2BrHg Ethane, (bromomercuri)-, 1870².
 C_2H_2BrMg Ethylmagnesium bromide, 1386⁴, 1869⁴, 2149², 2931², 4190².
 C_2H_2Cl See *Ethane, chloro-*.
 C_2H_2ClHg Ethane, (chloromercuri)-, 1870².
 C_2H_2ClO (See also *Ethanol, 2-chloro-*.) Ether, chloromethyl methyl, 2150⁴, 4523⁴.
 $C_2H_2Cl_2OP$ Phosphine, dichloroethoxy-, 3921².
 $C_2H_2Cl_2O$ Methanol, compd. with $CHCl_3$, 2641².
 $C_2H_2FeN_2OS_2$, 3869².
 C_2H_2HgI Ethane, (iodomercuri)-, 1870².
 $C_2H_2HgNO_2$ Ethane, (hydroxymercuri)-, nitrate, 1871¹.
 C_2H_2I See *Ethane, iodo-*.
 C_2H_2IMg Ethylmagnesium iodide, 2976², 3908², 4613².
 $C_2H_2KN_2$ Acetamidine, K salt, 590².
 C_2H_2KO See *Potassium chloride*.
 C_2H_2LiO Lithium ethoxide, 1044⁴.
 C_2H_2NO See *Acetamide*.
 C_2H_2NOS Acetamide, α -mercapto-, P 1649², 3677².
 $C_2H_2N_2$ Ethyl thionitrite, 785¹.
 $C_2H_2NO_2$ See *Ethyl nitrate; Glycine*.
 $C_2H_2NO_2$ Ethyl nitrate, 2703².

- C₂H₅NO₂ See *Ammonium oxalates*.
 C₂H₅N₂Na Acetamidine, Na salt, 590⁴.
 C₂H₅N₇ 1, 2, 3, 4-Tetrazole, 5-guanido-, and -HNO₂, 4471⁴.
 C₂H₅Na Ethane, Na deriv., 1386¹.
 C₂H₅NaO See *Sodium ethoxide*.
 C₂H₅OTl Thallium ethoxide, 2423³.
 C₂H₅O₂P Ethyl metaphosphate, 2418³.
 C₂H₅O₂P Acetic acid, phosphono-, 4443³, 4444¹.
 C₂H₅ See *Ethane*.
 C₂H₅AsClO₂ Ethaneearsonic acid, 2-chloro-, 91², 92⁴, 2158⁷.
 C₂H₅CaN₂ Compd. of Ca(CN)₂ and NH₃, P 4028⁴.
 C₂H₅ClO₂P Phosphoric acid, β-chloroethyl ester, Ba salt, 2418³.
 C₂H₅HgO Ethane, (hydroxymercuri)-, 187⁹.
 C₂H₅Hg₂O₂S Methane, (hydroxymercuri)-, sulfate, 1871².
 C₂H₅I₂Te Dimethyltellurium diiodide, 2933⁷.
 C₂H₅N₂O Urea, methyl-, 3442⁷.
 C₂H₅N₂O₂ Urea, (hydroxymethyl)thio-, 489².
 C₂H₅N₂O₂ Urea, (hydroxymethyl)-, 489⁴.
 C₂H₅N₂O₂ Biurea, 5163³.
 C₂H₅O See *Ethyl alcohol*; *Methyl ether*.
 C₂H₅OS Ethanol, 2-mercapto-, P 1649⁷.
 C₂H₅O₂ (See also *Glycol*)
 Methyl peroxide, 2932⁷.
 C₂H₅O₂S (See also *Ethylsulfuric acid*)
 Methyl sulfate, P 2990⁴, 3019⁴.
 C₂H₅S Methyl sulfide, 4925⁴.
 C₂H₅AsO₂ See *Cacodylic acid*.
 C₂H₅AsO₂ Ethaneearsonic acid, 2-hydroxy-, 2158⁷; Ca salt, 92².
 C₂H₅BF₃N Ethylammine boron fluoride, 5124⁷.
 C₂H₅BrLiN Addn. compd. from LiBr and Me₂NH, 2113⁷.
 C₂H₅BrLiN Addn. compd. from LiBr and Me₂NH, 2113⁷.
 C₂H₅ClLiN Addn. compd. from LiCl and Me₂NH, 2113⁷.
 C₂H₅LiLiN Addn. compd. from LiI and Me₂NH, 2113⁷.
 C₂H₅N See *Dimethylamine*; *Ethylamine*.
 C₂H₅NO Ethanol, 2-amino-, 2938³, P 3232⁴, 3824².
 C₂H₅NO₂ See *Ammonium oxalate*.
 C₂H₅N₂ See *Guanidine*, *methyl-*.
 C₂H₅N₂O₂ Guanidine, bicarbonate, 5171².
 C₂H₅N₂ Biguanide, 4930⁴.
 C₂H₅O₂P Phosphoric acid, mono-Et ester, salts, 2418⁴.
 C₂H₅O₂P Phosphoric acid, β-hydroxyethyl ester, 4937²; salts, 2418², 2418³.
 C₂H₅ClN₂O₂Pt, 1582⁴.
 C₂H₅ClN₂Pt, 1581³.
 C₂H₅ClN₂Pt, 1582³.
 C₂H₅ClN₂O₂Pt, 1583¹.
 C₂H₅N₂ See *Ethylenediamine*.
 C₂H₅N₂O See *Ammonium oxalates*.
 C₂H₅N₂O₂Pt, 1582⁴.
 C₂H₅AgLiN, 5429⁴.
 C₂H₅BrLiN Addn. compd. from LiBr and MeNH₂, 2118⁷.
 C₂H₅ClLiN Addn. compd. from LiCl and MeNH₂, 2118⁷.
 C₂H₅ClN₂O₂Pt, 1583³.
 C₂H₅ClN₂Pt, 1582¹.
 C₂H₅LiLiN Addn. compd. from LiI and MeNH₂, 2118⁷.
 C₂H₅ClN₂O₂Pt, 1582¹.
 C₂H₅ClN₂O₂Pt, 1583².
 C₂H₅ClN₂Pt, 1582¹, 1583³.
 C₂H₅CoN₂O₂S, 3839³.
 C₂H₅CrN₂O₂, 3511¹, 2900³.
 C₂H₅Mo₂N₂S₂ Guanidine perthiomolybdate, 4156⁷.
 C₂H₅Be₂O₂ + nH₂O, 351¹.
 C₂H₅ClN₂Pt, 1583⁴.
 C₂H₅ClN₂O₂Pt, 1583⁴.
 C₂H₅ClN₂Pt, 1583³.
 C₂H₅ClN₂O₂Pt, 1582⁷.
 C₂H₅ClN₂O₂Pt, 1582⁷.
 C₂HgK₂N₂O₂S, 1585⁴.
 C₂HgN₂ See *Mercury cyanide*.
 C₂HgN₂O₂ (See also *Mercury fulminate*)
 Mercury cyanate, 4421⁴.
 C₂HgN₂S₂ See *Mercury thiocyanate*.
 C₂HgN₂O₂ Mercury oxycyanide, 1210⁴.
 C₂I₂ Acetylene, diiodo-, 1614².
 C₂I₂N₂O₂ Ethylene, triiodonitro-, 1614².
 C₂I₂S₂ Ethylene, tetraiodo-, compd. with S, 1614².
 C₂K₂MgO₂ Magnesium potassium carbonate, 5127⁴.
 C₂K₂O₂ See *Potassium oxalate*.
 C₂MgNa₂O₂ Magnesium sodium carbonate, 5127⁴.
 C₂MoO₂, 4419³.
 C₂N₂ See *Cyanogen*.
 C₂N₂S₂ See *Thiocyanogen*.
 C₂N₂Zn See *Zinc cyanide*.
 C₂N₂Ti₂ Titanium cyanonitride, 1585⁹.
 C₂Na₂O₂ See *Sodium oxalate*.
 C₂NiO₂ See *Nickel oxalate*.
 C₂O₂Sn See *Tin oxalates*.
 C₂O₂Br See *Sironium oxalate*.
 C₂Al₂ See *Aluminum carbide*.
 C₂Bi₂O₂ See *Bismuth carbonate*.
 C₂CaN₂O₂, 4872⁹.
 C₂FeN₂S₂ See *Iron thiocyanate*.
 C₂H₅Mg₂O₂ + nH₂O, 50⁴.
 C₂H₅MoN₂O₂S₂, 2890⁹.
 C₂H₅MoN₂O₂S₂Th, 2890⁹.
 C₂H₅N₂ Malononitrile, 387¹, 1114⁴, 4941⁴.
 C₂H₅N₂O₂ Parabanic acid, 5416³.
 C₂H₅O₂ See *Mesoxalic acid*.
 C₂H₅BrMgN₂ Imidazolylmagnesium bromide, 1638⁷.
 C₂H₅Br₂N₂Ti₂ Addn. compd. of HCN and TiBr₄, 3868².
 C₂H₅ClO₂ Ethylene oxide, (trichloromethyl), 4683⁷.
 C₂H₅HgNNaO₂, 1585⁴.
 C₂H₅NO₂S 2, 4(3, 5)-Thiazoledione, 5164⁹.
 C₂H₅NS Thiazole, 4114².
 C₂H₅N₂O₂S Δ³ - 1, 3, 4 - Thiodiazoline - 4 - carbonylic acid, 2-amino-5-keto-, 2953³.
 C₂H₅ Allylene, P 608².
 Propine, 5075⁴.
 C₂H₅BrClO Propionyl chloride, β-bromo-, 5470⁹.
 C₂H₅BrF₂ Propane, 2-bromo-1-trifluoro-, 4441¹.
 C₂H₅Br₂OP Phosphine, dibromo(β-trifluoroisopropoxy)-, 4441¹.
 C₂H₅Br₂O Ethylene oxide, bromo(bromomethyl)-, 4925¹.
 Propionyl bromide, α-bromo-, 4463⁴.
 C₂H₅ClNO₂ Propene, 1-chloro-1-nitro-, 372⁷.
 C₂H₅N₂O Acetamide, α-cyano-, 2151¹, 4941¹.
 C₂H₅N₂O₂S 2, 4(3, 5)-Thiazoledione, 3-amino-, 5164⁷.
 C₂H₅O See *Acrolein*.
 C₂H₅O₂ (See also *Pyruvaldehyde*)
 Acrylic acid, P 4784⁴.
 C₂H₅O₂ (See also *Pyruvic acid*)
 Acrolein, α, β-dihydroxy-, 810⁴.
 Glucic acid, 1877⁴.
 Pyruvaldehyde, hydroxy-, 810⁴, 4974⁴.

- $C_3H_4O_4$** See *Malonic acid*.
 $C_3H_5AgO_3$ Propionic acid, α -mercapto-, silver deriv., Ag salt, 2202¹.
 C_3H_5Br See *Propene, 3-bromo-*.
 $C_3H_5BrCl_2$ Propane, 1-bromo-2,3-dichloro-, 2152¹.
 C_3H_5BrMg Allylmagnesium bromide, 1108², 1870¹.
 $C_3H_5BrMgO_3$ Carbonic acid, Et ester, bromo-magnesium salt, 4925⁹.
 $C_3H_5BrO_3$ Propionic acid, α -bromo-, 754¹, 4200¹.
 $C_3H_5Br_2NO_2$ Propane, 1,2-dibromo-1-nitro- β 372¹.
 C_3H_5Cl Propene, chloro-, 4620⁹.
 C_3H_5ClO (See also *Epichlorohydrin*.) Propionyl chloride, 3662².
 $C_3H_5ClO_2$ Acetic acid, chloro-, Me ester, 1320⁵, 3535².
 Propionic acid, chloro-, 1337¹, 4192⁵.
 $C_3H_5Cl_3$ Propane, 1,2,3-trichloro-, 2152².
 $C_3H_5Cl_3O_3S$ 2-Propanol, 1,3-dichloro-, chloro-sulfonate, 2152¹.
 $C_3H_5F_3O$ 2-Propanol, 1-trifluoro-, 4440⁹.
 C_3H_5HgN Ethane, (cyanomercuri), 1871¹.
 $C_3H_5IO_2$ Propionic acid, β -iodo-, 4200¹.
 C_3H_5N Propionitrile, 1027¹, 3539⁹.
 $C_3H_5NO_2$ Propene, 1-nitro-, 372¹.
 Pyruvaldehyde, oxime, 754⁹.
 $C_3H_5NO_3$ Carbamic acid, *N*-formyl-, Me ester, 5163⁷.
 $C_3H_5N_3NaS$ 2-Imidazolemercaptan, 4,5-dihydro-, Na deriv., 5164⁷.
 C_3H_5NNi Nickel cyanide, compd. with Me NH_3 , 2418¹.
 C_3H_5NO Glycocyamidine, 3985¹.
 Urea, α -cyano- β -methyl-, 2699⁹.
 $C_3H_5N_2OS$ 1,3,4 - Triadiazolid - 2 - one, 5 methylimino-, 2974¹.
 $C_3H_5N_2O_2$ 2,4(1,3) - s - Triazinedione, 5, 6 - dihydro-, P 4711¹.
 $C_3H_5N_2O_3$ See *Nitroglycerin*.
 $C_3H_5N_2S$ 2,4(1,3) - s - Triazinedione, 5,6 dihydrothio-, P 4711¹.
 C_3H_5 (See also *Propene*.)
 Cyclopropane, 4741⁹, 5075⁴.
 $C_3H_5AsCl_2$ Arsine, dichloro-(γ -chloropropyl), 92¹.
 $C_3H_5BrClO_3S$ 2-Propanol, 1-bromo 3-chloro-, acid sulfate, Na salt, 2152².
 C_3H_5BrNO Propionamide, β -bromo-, 5170⁹.
 $C_3H_5Br_2$ Propane, 1,3-dibromo-, 904¹.
 $C_3H_5Cl_2$ Propane, dichloro-, 4868⁹.
 $C_3H_5Cl_2O$ 2-Propanol, 1,3-dichloro-, 3440².
 $C_3H_5Cl_2O_3S$ 2-Propanol, 1,3-dichloro-, acid sulfate, and Na salt, 2152².
 $C_3H_5HgO_3$ Methane, (acetoxymmercuri), 1871¹.
 $C_3H_5HgO_3S$ Acetic acid, methylmercurimer-capto-, 3982¹.
 $C_3H_5N_2O_2$ (See also *Urea, acetyl-*.) Hydrazine, acetylformyl-, 836¹.
 Malonamide, 1797¹.
 $C_3H_5N_2O_3$ Hydanitic acid, 3442⁷.
 $C_3H_5N_2O_4$ Propylene nitrate, 4073⁹.
 Trimethylene nitrate, 4073⁹.
 $C_3H_5N_2S$ 2(3)-Imidazolone, 4,5-dihydro-2-thio-, and -HCl, 2953¹.
 $C_3H_5N_4$ 1,2,3,4-Tetrazole, 1,5-dimethyl-, P 1909¹.
 $C_3H_5N_4OS$ 2,4(3,5)-Thiazoledione, 3-amino-, 2-hydrazones, di-HCl, 5164⁷.
 $C_3H_5N_5O$ 1,2,3,5 - Tetrazole, 4 - β - methyl-carbamido-, 2699¹.
 C_3H_6O See *Acetone, Allyl alcohol, Propene oxide; Propionaldehyde*.
 C_3H_6OS Xanthic acid, K salt, P 16497⁸.
 $C_3H_6O_2$ (See also *Acetic acid, methyl ester; Formic acid, ethyl ester, Propionic acid*.) Glycidol, 1560³.
 Lactaldehyde, 2151¹.
 2-Propanone, 1-hydroxy-, 373⁵.
 $C_3H_6O_2S$ s-Trithiane, 1,3-dioxide, 4202⁵.
 $C_3H_6O_3$ (See also *Glyceraldehyde; Lactic acid; Propanone, dihydroxy-*.)
 Carbonic acid, di-Me ester, 1058¹.
 Glycol, monoformate, 3207⁷.
 Hydracrylic acid, 3496⁷.
 Propionic acid, hydroxy-, 1927⁵.
 $C_3H_6O_3S$ Trimethylenetrissulfoxide, 4202⁵.
 $C_3H_6O_4$ See *Glyceric acid*.
 $C_3H_6O_5S$ 1 - Propanesulfonic acid, 2 keto-, 4187¹.
 $C_3H_6S_2$ 1,3-Dithiole, 4,5-dihydro-, 97¹.
 C_3H_6AsI Arsine, diiodopropyl-, 120⁹.
 C_3H_6AsO Propane, 1-arsinoso-, 121¹.
 C_3H_6Br See *Propane, bromo-*.
 C_3H_6BrHg Propane, 1-(bromomercuri)-, 1870¹.
 C_3H_6BrMg Isopropylmagnesium bromide, 2934¹.
 Propylmagnesium bromide, 2934¹.
 $C_3H_6CaO_3P$ Calcium glycerophosphate, 790⁷.
 C_3H_6Cl See *Propane, chloro-*.
 C_3H_6ClHg Propane, 1-(chloromercuri)-, 1870¹.
 C_3H_6ClO Ether, β -chloroethyl methyl, 2422⁸.
 $C_3H_6ClO_2$ 1,2-Propanediol, 3-chloro-, 4685¹.
 $C_3H_6ClO_3S$ 2-Propanesulfonyl chloride, 2-hydroxy-, 95¹.
 Propyl chlorosulfonate, 1107¹.
 C_3H_6HgI Propane, 1-(iodomercuri)-, 1870¹.
 $C_3H_6HgNO_3$ Propane, 1-(hydroxymmercuri)-, nitrate, 1871¹.
 C_3H_6I See *Propane, iodo*.
 C_3H_6LN Trimethylamine, diiodo-, P 3717¹.
 C_3H_6KN Propionamidine, K salt, 596¹.
 C_3H_6NO Acetamide, *N*-methyl-, 2419¹.
 $C_3H_6NO_2$ (See also *Alanine; Carbamic acid, Et ester*.)
 Acetamide, *N*-(hydroxymethyl)-, P 1136¹.
 $C_3H_6NO_3S$ See *Cysteine*.
 C_3H_6NO Serine, 1877¹.
 C_3H_6NS 1,3,5-Dithiazine, 5,6-dihydro-, 4704¹.
 C_3H_6NNa Propionamidine, Na salt, 596¹.
 $C_3H_6N_2O$ Biuret, 1-methyl-, 3442¹.
 Glycocyamine, 3985¹.
 $C_3H_6O_3P$ Propionic acid, α -phosphono-, 4444³.
 C_3H_6 See *Propane*.
 $C_3H_6AsClO_3$ 1-Propanearsonic acid, 3-chloro-, 92¹.
 C_3H_6HgO Propane, 1-(hydroxymmercuri)-, 1870¹.
 $C_3H_6N_2O$ Urea, α , α -dimethyl-, 3442².
 Urea, ethyl-, 3442⁷.
 $C_3H_6N_2OS$ Urea, bis(hydroxymethyl)thio-, P 5197¹.
 $C_3H_6N_2O_2$ Urea, bis(hydroxymethyl)-, P 942², P 3236¹, P 4090⁷, P 5197¹.
 $C_3H_6N_2S$ Pseudourea, γ -ethylthio-, P 2447¹.
 $C_3H_6N_2O$ Urea, α -guanyl- β -methyl-, 2699¹.
 Urea, methylguanil-, 4930⁷.
 $C_3H_6N_2O_2$ Urea, methylenebis-, P 4711¹.
 $C_3H_6N_2O_3S$ Methionamide, *N*, *N'*-dimethyl-, *N*, *N'*-dinitro-, 98¹.
 $C_3H_6N_2S$ Urea, methylenebis(thio-, P 4711¹.
 C_3H_6O (See also *Isopropyl alcohol; Propyl alcohol*.)
 Ether, ethyl methyl, 5158¹.
 $C_3H_6O_2$ Ethanol, 2-methoxy-, 2422⁸.
 Methylal, 1800⁹.
 Peroxide, ethyl methyl, 2932¹.

- Propanediol, 2429⁴, P 3232⁴, 5343¹.
 C₂H₅O₂S 1,2-Propanediol, 3-mercapto-, P 1649⁴.
 C₂H₅O₂ See *Glycerol*.
 C₂H₅O₂S 2-Propanesulfonic acid, 2-hydroxy-, salts, 94⁴.
 C₂H₅AsO₂ 1-Propanearsonic acid, 3-hydroxy-, and Ca salt, 92⁴.
 C₂H₅BrLiN Addn. compd. from LiBr and Me₃N, 2118⁴.
 C₂H₅BrSn Stannane, bromotrimethyl-, 4670¹.
 C₂H₅BrTe Trimethyltellurium bromide, 2933⁴.
 C₂H₅ClLiN Addn. compd. from LiCl and Me₃N, 2118⁴.
 C₂H₅ILiN Addn. compd. from LiI and Me₃N, 2118⁴.
 C₂H₅LiLiN Addn. compd. from LiI and Me₃N, 2118⁴.
 C₂H₅N See *Propylamine*; *Trimethylamine*.
 C₂H₅NO 1-Propanol, 3-amino-, 2938⁴.
 Trimethylamine, oxide, 2219⁴.
 C₂H₅N₂O Urea, (β-aminoethyl)-, and -HCl, P 3717⁴.
 C₂H₅N₂O Guanidine, methyl-, formate, 3443¹.
 C₂H₅O₂P Methyl phosphite, 2703⁴.
 C₂H₅O₂P Methyl phosphate, 2703⁴.
 Phosphoric acid, mono-Pr ester, Ba salt, 218⁴.
 C₂H₅O₂P Glycerophosphoric acid, 4909⁴.
 C₂H₅AsNO₂ 1-Propanearsonic acid, 3-amino-, 92⁴.
 C₂H₅N₂ 1,3-Propanediamine, 2939¹.
 C₂H₅N₂O₂ Methionamide, N, N'-dimethyl, 98⁴.
 C₂H₅BrCdN₂, 3868¹.
 C₂H₅CdLiN₂, 3868¹.
 C₂H₅ClO₂, 2871⁴.
 C₂H₅N₂ 1,2,3-Propanetriamine, 3868¹.
 C₂H₅BiCl₂N₂S Compd. of BiCl₃ with (H₂N)₂CS, 5368⁴.
 C₂H₅N₂O Guanidine, carbonate, 1404¹.
 C₂H₅N₂S Guanidine, trithiocarbonate, 1881¹.
 C₂H₅ClCoN₂O₂, 3868⁴.
 C₂H₅CoN₂O₂Se + 3H₂O, 3869¹.
 C₂H₅CoN₂O₂ + H₂O, 3869¹.
 C₂H₅BrLiN Addn. compd. from LiBr and MeNH₂, 2118⁴.
 C₂H₅ClLiN Addn. compd. from LiCl and MeNH₂, 2118⁴.
 C₂H₅CrN₂S, 350⁴.
 C₂H₅LiLiN Addn. compd. from LiF and MeNH₂, 2118⁴.
 C₂H₅NNH₂O₂, 2896⁴.
 C₂N₂EtS₂ + 2H₂O, 2674¹.
 C₂N₂S₂Sm Samarium thiocyanate, 4139¹.
 C₂Ag₂ Methane, tricyano-, silver deriv., 1583⁴.
 C₂BaCl₂HgN₂, 2344¹.
 C₂BaMoO₂ + 5H₂O, 2898⁴.
 C₂BaPt Barium cyanoplatinite, 3408⁴.
 C₂Br₂ Methanetrinitrile, bromo-, 1583⁴.
 C₂Br₂FeHgO₂, 4417⁴.
 C₂Br₂FeO₂ Tetracarbonyl ferrous bromide, 353⁴.
 C₂Br₂FeN₂ Addn. compd. from BrCN and FeBr₃, 2868⁴.
 C₂Br₂FeN₂ Addn. compd. of BrCN and FeBr₃, 2868⁴.
 C₂Cl₂FeHgO₂, 351⁴.
 C₂Cl₂FeO₂ Tetracarbonyl ferrous chloride, 363⁴.
 C₂CoEO₂ Cobalt potassium oxalate, 2386⁴.
 C₂CoO₂ See *Cobalt carbonyl*.
 C₂FeHgO₂, 4417⁴.
 C₂FeHg₂LiO₂, 4417⁴.
 C₂FeHg₂O₂S, 4417⁴.
 C₂FeLiO₂, 353⁴, 4417⁴.
 C₂FeO₂ See *Iron carbonyls*.
 C₂HI Butadiene, iodo-, 2930⁴.
 C₂HN₂ Methanetrinitrile, 1583⁴.
 C₂H₅CaN₂, 227⁴.
 C₂H₅Od Cadmium acetylide, 815⁴.
 C₂H₅Od₂ Cadmium acetylide, CdI₂ compd., 815⁴.
 C₂H₅Cl₂K₂N₂NiO₂ Glyoxime, chloro-, Ni K deriv., 4693⁴.
 C₂H₅Mg₂O₂, 50⁴, 1555⁴.
 C₂H₅N₂O₂ See *Alloxan*.
 C₂H₅O₂ See *Maleic anhydride*.
 C₂H₅BrS Thiophene, 2-bromo-, 4690¹.
 C₂H₅ClO₂ Acetic acid, trichloro-, vinyl ester, P 608¹.
 C₂H₅Cl₂S Compd., b₁ 134-4.5°, from (CICH₂)₂S, 2933⁴.
 Sulfide, α,β-dichloroethyl trichlorovinyl, 2933⁴.
 —, α,β-dichlorovinyl α,β,β-trichloroethyl, 2933⁴.
 C₂H₅Cl₂S Ethyl sulfide, heptachloro deriv., 2933⁴.
 Sulfide, α,β-dichloroethyl pentachloroethyl, 2933⁴.
 —, α,α,β,β-tetrachloroethyl α,β,β-trichloroethyl, 2933⁴.
 C₂H₅N₂O Violuric acid, 2154⁴.
 C₂H₅BrMgN₂ Pyrrolmagnesium bromide, 3465⁴.
 C₂H₅ClNO₂ Succinimide, N-chloro-, 225⁴.
 C₂H₅Cl₂O₂ Acetic anhydride, α,α'-dichloro-, P 3234⁴.
 C₂H₅Cl₂S Sulfide, β-chloroethyl trichlorovinyl, 2933⁴.
 Sulfide, β-chlorovinyl α,β,β-trichloroethyl, 2933⁴.
 —, α,β-dichloroethyl α,β-dichlorovinyl, 2933⁴.
 C₂H₅Cl₂S Sulfide, α,β-dichloroethyl α,α,β,β-tetrachloroethyl, 2933⁴.
 Sulfide, α,α,β-trichloroethyl α,β,β-trichloroethyl, 2933⁴.
 C₂H₅Co₂K₂N₂Na₂O₂ + H₂O, 4634¹.
 C₂H₅KO₂ Sb See *L tartar emetic*.
 C₂H₅K₂MoN₂O₂ + 6H₂O, 575¹.
 C₂H₅NNaO₂ Succinimide, Na deriv., P 1418⁴.
 C₂H₅N₂O₂Se + 2H₂O Ammonium scandium oxalate, 3180⁴.
 C₂H₅N₂ Pyrazine, 4218⁴.
 Succinonitrile, 1027⁴, 3539⁴.
 C₂H₅N₂O₂ Dialuric acid, 2638⁴.
 C₂H₅O₂ See *Furan*.
 C₂H₅O₂ Isocrotonic acid, γ-hydroxy-, γ-lactone, 817⁴.
 C₂H₅O₂ See *Fumaric acid*; *Maleic acid*.
 C₂H₅O₂ Succinic acid, epoxy-, 2083⁴.
 C₂H₅O₂ Maleic acid, dihydroxy-, 3902⁴.
 C₂H₅ See *Thiophene*.
 C₂H₅Se Selenophene, 137⁴, 2417⁴, 3658⁴.
 C₂H₅BrO₂ Succinic acid, bromo-, 2347⁴.
 C₂H₅BrCl₂ Propane, 1,2-dibromo-1,3-dichloro-2-(chloromethyl)-, 4928⁴.
 C₂H₅Br₂ Propane, 1,3-dibromo-2-(chloromethyl)-, 4927⁴, 4928⁴.
 C₂H₅Od₂N₂O₂, 4194⁴.
 C₂H₅OSO₂ Crotonyl chloride, 2997⁴.
 Trimethylene oxide, 3-(chloromethylene)-, 4928⁴.
 C₂H₅ClO₂ Formic acid, chloro-, allyl ester, 141⁴.
 C₂H₅ClO₂ Acetic anhydride, chloro-, 4444⁴.
 C₂H₅ClNO₂ Glycine, N-dichloroacetyl-, 1480⁴.
 C₂H₅Cl₂ Propene, 1,3-dichloro-2-(chloromethyl)-, 4927⁴, 4928⁴.
 C₂H₅ClO₂ Butyric acid, trichloro-, 1339⁴.

- $C_2H_5Cl_2S$ Sulfide, β -chloroethyl α,β -dichloro-vinyl, 2933¹.
- $C_2H_5Cl_3$ Propane, 1, 1, 2, 3-tetrachloro-2-(chloromethyl)-, 4928².
- $C_2H_5Cl_3S$ Ethyl sulfide, pentachloro deriv., 2933².
- C_3H_5N (See also *Pyrrrole*.)
Cyclopropanenitrile, 4443⁹.
- $C_3H_5NO_2$ 2-Propanone, 1-thiocyano-, 101⁷.
- $C_3H_5NO_2$ Acetic acid, cyano-, Me ester, 4620⁹
Succinimide, 754⁹, 3018⁹.
- $C_3H_5NO_2Se$ Propionic acid, α (and β)-seleno cyano-, and K salt, 2154⁴.
- $C_3H_5NO_3$ Malic acid, nitrate, 1620¹.
- C_3H_5NS See *Isothiocyanoic acid*, allyl ester.
- $C_3H_5N_2O_2$ 4,5-Imidazolidone, 2,3-dihydro-2-imino-1-methyl-, 3443¹.
- $C_3H_5N_2O_2S$ 1,3,4-Thiadiazolid-2-one, 4-acetyl-5-imino-, 2974⁹.
- $C_3H_5N_4$ *s*-Triazine, 1,4-*endo*-methylene-2-amino-6-imino-, -HCl, 4931⁴.
- C_4H_8 (See also *Birnyl*.)
Butadiene, P 3715⁴, P 4802⁵
Butene, P 2722¹.
- $C_4H_8AsCuO_2$ Copper acetoarsenite, 5590⁶.
- C_4H_8Br Propene, 3-bromo-2-(bromomethyl)-, 4925¹.
- $C_4H_8Br_2Cl$ Propane, 1,2-dibromo-3-chloro-2-(chloromethyl)-, 4928².
- $C_4H_8Br_2O$ Propionic acid, α,β -dibromo-, Me ester, 2422⁷.
- C_4H_8BrNO Propane, 1,3-dibromo-2-(bromomethyl)-2-nitro-, 4927¹.
- C_4H_8Br Propane, tribromo-2-(bromomethyl)-, 4927¹, 4928¹.
- $C_4H_8Br_2O$ Ether, bis(α,β -dibromomethyl)-, 2934².
- C_4H_8ClNO 1-Butene, 1-chloro-1-nitro-, 372⁷.
- $C_4H_8ClNO_2$ Trimethylene oxide, 3-chloro-methyl-, 3-nitro-, 4927⁴, 4928¹.
- C_4H_8Cl Propene, 3-chloro-2-(chloromethyl)-, 4928¹.
- $C_4H_8Cl_2O$ Butyl chloride, β -chloro-, 1389¹.
- $C_4H_8Cl_2NO$ Propane, 1,3-dichloro-2-(chloromethyl)-2-nitro-, 4927¹.
- $C_4H_8Cl_3$ Propane, trichloro-2-(chloromethyl)-, 4927¹, 4928¹.
- $C_4H_8Cl_4O$ Acetone, compd. with CCl_4 , 2641⁹.
- C_4H_8CoO See *Cobalt acetate*.
- C_4H_8HgO See *Mercury acetate*.
- C_4H_8NNaO Diacetamide, Na deriv., P 1418⁹.
- C_4H_8N Imidazole, methyl-, 4470¹.
- $C_4H_8N_2O_2$ (See also *Piperazine-2-one*.)
Hydantoin, methyl-, 3256¹.
- Oxamimidic acid, vinyl ester, 2941⁴.
- C_4H_8NS Thiazole, 3-amino-4-methyl-, and $AgNO_3$ compd., 101⁷.
- $C_4H_8N_2O_2S$ 2,4(3,5)-Thiazolidone, 2-semicarbazone, 5165¹.
- $C_4H_8N_2O_3$ See *Allantoin*.
- $C_4H_8N_2O_4$ Erythritol, tetranitrate, 708¹.
- C_4H_8NIO See *Nickel acetate*.
- C_4H_8O (See also *Crotonaldehyde*.)
Trimethylene oxide, 3-methylene-, 4928¹.
Vinyl ether, 2932¹.
- $C_4H_8O_2$ (See also *Biacetyl*; *Crotonic acid*; *Isocrotonic acid*; "vinyl ester" under *Acetic acid*.)
 β -Butenic acid, 1870⁹, 3207³.
Cyclopropanecarboxylic acid, 4443⁹.
- $C_4H_8O_3$ 1,3-Dithiole-2-carboxylic acid, 4,5-dihydro-, and K salt, 971⁴.
- $C_4H_8O_3Sr$ Strontium thioacetate, 3023⁹.
- $C_4H_8O_4$ See *Acetic anhydride*; *Acetoacetic acid*.
- $C_4H_8O_5$ (See also *Succinic acid*.)
- Glycolaldehyde, Me carbonate, 3902⁹.
- Malonic acid, methyl-, 5162¹, and di-Na salt, 4871¹.
- Oxalic acid, di-Me ester, 3621⁴.
- $C_4H_8O_5Pb$ See *Lead acetate*.
- $C_4H_8O_5S$ Acetic acid, thiohis-, 1899⁹.
- $C_4H_8O_5S$ Acetic acid, dithiohis-, 1613¹.
- $C_4H_8O_5Zn$ See *Zinc acetate*.
- $C_4H_8O_6$ See *Malic acid*.
- $C_4H_8O_6$ See *Tartaric acid*.
- $C_4H_8O_6$ Succinic acid, tetrahydroxy-, 2424⁹, 3472⁴.
- $C_4H_8O_6S$ 1550⁹.
- $C_4H_8AsCl_2O$ Ethanol, 2-dichloroarsyl-, acetate, 91¹, 2158⁴.
- C_4H_8Br 2-Butene, 1-bromo-, P 851⁴, 2695⁴, P 3718⁴, P 4713⁵.
- C_4H_8BrMgO Carbonic acid, isopropyl ester, bromomagnesium salt, 4923⁹.
Carbonic acid, Pr ester, bromomagnesium salt, 4925⁹.
- $C_4H_8BrO_2$ 1,3-Dioxolane, 2-(bromomethyl)-(?), 2932¹.
- C_4H_8BrNO Butane, 1,2-dibromo-1-nitro-, 372⁷.
- C_4H_8ClO Butyl chloride, 2151⁷.
Ether, allyl chloromethyl-, P 612².
- C_4H_8ClO Acetic acid, chloro-, Et ester, 1326⁴, 2970⁹.
Butyric acid, β -chloro-, 1388⁴, 1876⁴.
- C_4H_8ClNO 1-Propanol, 3-chloro-2-(chloromethyl)-2-nitro-, 4927⁴, 4928¹.
- C_4H_8ClO See *Chlorotone*.
- $C_4H_8Cl_2O$ 1,1-Butanediol, 2,2,3-trichloro-, 817⁴.
- C_4H_8HgN Propane, 1-(cyanomercuri)-, 1871¹.
- C_4H_8NO Isobutyronitrile, α -hydroxy-, 102⁴.
2-Pyrrolidone, 819⁴.
- C_4H_8NO 1-Butene, 1-nitro-, 372⁷.
2-Pyrrolidone, 4-hydroxy-, 373⁹.
- $C_4H_8NO_2$ Acetic acid, 4205⁹.
- $C_4H_8NO_2$ See *Aspartic acid*.
- $C_4H_8NO_3S$ 1,3-Propanediol, 2-(hydroxymethyl)-2-nitro-, cyclic sulfate, 4927¹.
- C_4H_8Ni Nickel cyanide, compd. with $EtNH_4$, 2418⁴.
- C_4H_8NO (See also *Creatinine*.)
Urea, α -cyano α,β -dimethyl-, 2699⁴.
- $C_4H_8N_2O$ 2(1)-*s*-Triazone, tetrahydro-4,6-dimino-1-methyl-, 2699⁴.
- Urea, α -cyano α,β -dimethyl-, 2699⁴.
- $C_4H_8N_2O$ 1,2,3,4-Tetrazole-5-carbamic acid, Et ester, 4471².
- C_4H_8S See *Butene*; *Propene*, 2-methyl-.
 $C_4H_8AuCl_2S$, 1586¹.
- C_4H_8Br Butane, 2,3-dibromo-, 4438⁹.
- $C_4H_8BrN_2NiO$, 3417⁴.
- C_4H_8BrSe Selenophene, 2,3,4,5-tetrahydro-, 1,1-dibromide, 3704².
- C_4H_8BrSe Selenophene, 2,3,4,5-tetrahydro-, perbromide, 3704².
- C_4H_8ClNO Butyric acid, β -amino- α -chloro-, and -HCl, 1876⁴.
- $C_4H_8ClNO_2$ 2-Butanol, 1-chloro-1-nitro-, 372⁷.
- $C_4H_8Cl_2$ Propane, 1,3-dichloro-2-methyl-, 4928¹.
- $C_4H_8Cl_2HgSe$ Selenophene, 2,3,4,5-tetrahydro-, HgCl₂ compd., 3701¹.
- $C_4H_8Cl_2N_2NiO$ + $2H_2O$, 3417⁴.
- $C_4H_8Cl_2O$ Ether, β,β' -dichloroisopropyl methyl-, 3440¹.
Ether, β,γ -dichloropropyl methyl-, 3440¹.
- $C_4H_8Cl_2O_2S$ Ethanol, 2-chloro-, sulfate, 1107⁴.
- $C_4H_8Cl_2S$ See *Sulfide*, bis(β -chloroethyl).
- $C_4H_8Cl_2Se$ Selenophene, 2,3,4,5-tetrahydro-, 1,1-dichloride, 3704¹.

- C₂H₅Cl₂N** *tert*-Butylamine, β, β', β'' -trichloro-, -HCl, 4927¹.
C₂H₅Cl₂NO Hydroxylamine, β -(β, β', β'' -trichloro-*tert*-butyl)-, 4927¹.
C₂H₅Cl₂PtSe Selenophene, 2, 3, 4, 5-tetrahydro-, 1-chloroplatinate, 3704².
C₂H₅HgO₂ Ethane, (acetoxymercuri)-, 1871¹.
C₂H₅HgO₂S Acetic acid, ethylmercurimercapto-, 3983⁷.
C₂H₅INO Butyramide, *N*-iodo-, 4624⁸.
C₂H₅I₂Se Selenophene, 2, 3, 4, 5-tetrahydro-, 1, 1-diiodide, 3704².
C₂H₅K₂N₂ Succinamidine, di-K salt, 596⁸.
C₂H₅NNaO₂ + 4H₂O Ammonium sodium tartrate, 1330⁴.
C₂H₅N₂OS Acetamide, acetamidothio-, 3470³.
C₂H₅N₂O₂ See *Glyoxime, dimethyl*-.
C₂H₅N₂O₂ See *Asparagine; Glycine, N-glycyl*-.
C₂H₅N₂O₂ Diethylene glycol, dinitrate, 4073⁹.
C₂H₅N₂S See *Thiosinamine*-.
C₂H₅N₂S₂ Disulfide, bis(methylthiocarbamyl), 1307².
C₂H₅N₃ *s*-Triazole, 3-amino-5-ethyl-, and *n* isomers, 3470⁹.
C₂H₅N₃O₂ Allantoic acid, 4713⁴.
C₂H₅O (See also 2-Butanone; Butyraldehyde; Isobutyraldehyde.)
 Δ^2 -2-Butenol, 2695¹.
 Crotonyl alcohol, 2695¹.
 Ethylene oxide, α, α -dimethyl-, 4472⁹.
C₂H₅OS Acetic acid, thiol-, Et ester, 2939⁸.
C₂H₅O₂ (See also Aldol; Butyric acid; Ethyl acetate; Isobutyric acid.)
 2-Butanone, 3-hydroxy-, 373⁸.
 Butyraldehyde, α -hydroxy-, 4670⁷.
p-Dioxane, 818¹, 3439⁹, 4444¹.
 1, 3-Dioxolane, 2-methyl-, P 608¹.
 Formic acid, isopropyl ester, 1326⁷, 3535².
 Formic acid, Pr ester, 1326⁷, 3621⁴.
 Isobutyraldehyde, α -hydroxy-, 4670⁷.
 Propionic acid, Me ester, P 397¹, 3621⁴.
C₂H₅O₂ (See also Butyric acid, hydroxy-) *5-m*-Dioxanolf 99¹, 1875⁸.
 1, 3-Dioxolane-4-carbinol, 99¹, 1875⁸.
 Glycol, monoacetate, P 1417³.
 Lactic acid, Me ester, P 849⁸.
C₂H₅O₃ Erythrose, 3876².
 Formin, mono-, 1107², 1867⁷.
C₂H₅Se Selenophene, 2, 3, 4, 5-tetrahydro-, 3704².
C₂H₅Se₂ 1, 2-Diseleninane, 3704².
C₂H₅AsO₂ Diglycolarsenic acid, 595⁸.
C₂H₅AuCl₂Se₂, 1586⁷.
C₂H₅Br See *Butane, bromo*; *Propane, bromomethyl*-.
C₂H₅BrHg Butane, 1-(bromomercuri)-, 1870⁷.
C₂H₅BrMg Butylmagnesium bromide, 2934³, 3437⁷, 4188³, 4442⁹.
sec-Butylmagnesium bromide, 2934³.
tert-Butylmagnesium bromide, 2934³.
 Isobutylmagnesium bromide, 2934³.
C₂H₅BrO₂Se Selenophene, 2, 3, 4, 5-tetrahydro-, 1-hydroxy 1-bromide, 3704².
C₂H₅Cl Butane, chloro-, 3835⁴.
C₂H₅ClHg Butane, 1-(chloromercuri)-, 1870⁷.
C₂H₅ClMg Butylmagnesium chloride, 2934³.
tert-Butylmagnesium chloride, 1107⁷.
C₂H₅ClO 1-Butanol, 4-chloro-, 2422⁹, 4444¹.
C₂H₅ClOSe Selenophene, 2, 3, 4, 5-tetrahydro-, 1-hydroxy 1-chloride, 3704².
C₂H₅HgI Butane, 1-(iodomercuri)-, 1870⁷.
C₂H₅HgNO₂ Butane, 1-(hydroxymercuri)-, nitrate, 1871¹.
C₂H₅I See *Butane, iodo*; *Propane, 1-iodo-2-methyl*-.
C₂H₅IMg Butylmagnesium iodide, 2934³.
C₂H₅IO₂ 1-Propanol, 3-iodo-2-methoxy-, P 3234¹.
C₂H₅KN Butyramidine, K salt, 596⁸.
C₂H₅NO Morpholine, P 2723⁴, P 4483⁷.
 Propionaldehyde, β -methylamino-, 3209².
C₂H₅NO₂ Butyl nitrite, 2703⁴.
 Glycine, *N, N*-dimethyl-, salts, 1111¹.
 Isobutyric acid, α -amino-, 3901⁸.
C₂H₅NO₂ Butyric acid, γ -amino- β -hydroxy-, 373⁸.
C₂H₅NO₂ 1, 3-Propanediol, 2-(hydroxymethyl) 2-nitro-, 4927⁴.
C₂H₅N₂Na Butyramidine, Na salt, 596⁸.
C₂H₅N₂O Guanidine, acetylmethyl-, and -HCl, 3443⁹.
 Δ^2 -Oxazoline, 2-amino-5-(aminomethyl)-, chloroplatinate, 2177².
C₂H₅N₂O₂ Biuret, 1, 1-dimethyl-, 3442⁴.
 Biuret, 1-ethyl-, 3442⁴.
C₂H₅N₂O₂S Carbazic acid, β -carbamylothio-, Et ester, 2953⁸.
 Carbazic acid, β -thiocarbamyl-, Et ester, 2953⁸.
C₂H₅N₂O₂ α -Bignuideacetic acid, -HCl, 4930⁹.
C₂H₅ See *Butane; Propane, 2-methyl*-.
C₂H₅AsCl Arsine, chlorodithiyl-, 1614³.
C₂H₅BrN Butylamine, γ -bromo-, 4669⁸.
C₂H₅Br₂Te Diethyltellurium dibromide, 2113⁷.
C₂H₅BrN Butylamine, β -chloro-, 4669⁸.
C₂H₅ClN₂O Guanidine, α -(γ -chloro- β -hydroxypropyl)-, -HCl, 2177².
C₂H₅ClO₂P Phosphoric acid, β -chloroethyl dimethyl ester, 1874⁹.
C₂H₅Cl₂Te Diethyltellurium dichloride, 2113⁷.
C₂H₅FeS Ethyl mercaptan, iron deriv., 785².
C₂H₅Hg Mercury diethyl, 1870⁷.
C₂H₅HgO Butane, 1-(hydroxymercuri)-, 1870⁷.
C₂H₅HgO₂Se Ethane, (hydroxymercuri)-, sulfate, 1871¹.
C₂H₅I₂Te Diethyltellurium diiodide, 2113⁷.
C₂H₅I₂Te Diethyltellurium tetraiodide, 2113⁷.
C₂H₅N₂ (See also *Piperazine*.)
 Diimide, isopropylmethyl-, 1877².
 Propane, methylazo-, 4617².
C₂H₅N₂O₂ Glycine, *N*-(β -aminoethyl)-, and di-HCl, 2183⁴.
C₂H₅N₂S Pseudourea, α -ethyl- γ -methylthio-, P 2447⁴.
 Pseudourea, trimethylthio-, 1115⁴, P 2447⁴.
 Urea, trimethylthio-, 1115⁴.
C₂H₅N₂O₂P See *Creatinephosphoric acid; Phosphagen*-.
C₂H₅N₂O₂ Hydrazine, *s*-bis(methylcarbamy)-, 2699⁹.
 Urea, α, α' -ethylenebis-, 3442⁹.
C₂H₅N₂S Pseudourea, β -ethyl- α -guanlythio-, -HBr, 4931⁹.
C₂H₅O (See also *Butyl alcohol; tert*-Butyl alcohol; *Ethyl ether; Isobutyl alcohol*.)
 Ether, methyl propyl, 5158⁴.
C₂H₅O₂ Butanediol, 470⁹, P 3933², 4444¹, 4930¹.
 Ethanol, 2-ethoxy-, P 846⁹, P 847¹.
 Ethyl peroxide, 2932⁸.
C₂H₅O₂Se Ethyl sulfone, 2419⁹.
C₂H₅O₂Se Selenophene, 2, 3, 4, 5-tetrahydro-, 1, 1-dihydroxide, 3704².
C₂H₅O₂Te, 2113⁷.
C₂H₅O₂ Diethylene glycol, 90⁹, 4444¹.
 Propanediol, methoxy-, 818¹, 3440¹.
C₂H₅O₂ See *Erythrid*-.

- $C_2H_5O_2S$ Ethyl sulfate, 1132³.
 $C_4H_{10}O_2Se$ 1,4-Butanediseleninic acid, di-
 HNO_3 , 3704⁴.
 $C_2H_5S_2$ Ethyl sulfide, $HgCl_2$ compd., 3565²,
4925⁵.
 $C_2H_5S_2$ Ethyl disulfide, 97⁴.
 $C_2H_5S_3$ Pentasulfide, diethyl, 4927¹, 5158⁷.
 C_2H_5Se Ethyl selenide, 1500³, 2622³.
 C_2H_5Tl Thallium diethyl, 787¹.
 C_2H_5Zn Zinc diethyl, 1386^{3,4}, 4443¹.
 $C_2H_5BF_3N$ Diethylammino boron fluoride,
5124⁷.
 C_2H_5BrSn Stannane, bromoethyltrimethyl-,
1870⁴.
 C_2H_5ClO , 2871⁴.
 C_2H_5N See *Butylamine*; *Diethylamine*; *Iso-*
butylamine.
 $C_2H_5NO_2$ Diethylamine, β, β' -dihydroxy-, 3824¹.
1-Propanol, 3-amino-2-methoxy-, P 3234².
 $C_2H_5N_2O$ Guanidine, α -(β -hydroxyethyl)- α -
methyl-, P 155⁹.
 $C_2H_5N_3$ Biguanide, α, β (and α, ϵ)-dimethyl-,
salts, 4931^{2,3}.
 $C_2H_5N_3O$ Biguanide, α -(β hydroxyethyl)-,
 H_2SO_4 , 4931³.
 $C_2H_5N_3S$ Biguanide, α -(β -mercaptoethyl)-, *hy-*
drogen sulfate, 4931³.
 $C_2H_5O_4P$ Phosphoric acid, di-Et ester, salts,
2418^{4,5}.
 $C_2H_5O_4P$ Phosphoric acid, bis(β -hydroxyethyl)
ester, *Ba salt*, 2418⁴.
 $C_2H_5AsNO_2$ Ethaneauronic acid, 2-dimethyl-
amino-, and HCl , 92⁴.
 $C_2H_5BrLiTe$ Trimethyltelluronium bromide,
compd. with $TeMe_3$, 2934¹.
 $C_2H_5BrLiTe$ Trimethyltelluronium iodide,
compd. with $TeMeBr$, 2934¹.
 $C_2H_5ClNO_4$ Tetramethylammonium perchlorate,
3617⁴, 5272².
 $C_2H_5ClO_2$, 2871⁴.
 C_2H_5IN Tetramethylammonium iodide, 1790⁴,
3617⁴.
 $C_2H_5MnNO_4$ Tetramethylammonium perman-
ganate, 5372².
 $C_2H_5N_2$ 2,3-Butanediamine, and salts, 3662⁹,
3663¹.
Hydrazine, α -isopropyl- β -methyl-, 1877¹.
Putrescine, 5608⁹.
 $C_2H_5N_2S_2$ Ethylamine, dithiobis-, 3041³, 4445⁷.
 $C_2H_5N_3$ Guanidine, α -(γ -aminopropyl)-, and
salts, 1881¹.
 C_2H_5OSn Stannane, ethylhydroxydimethyl-,
1870⁴.
 C_2H_5Pb Plumbane, tetramethyl-, 1500³, 2622³,
4670³.
 C_2H_5Sn Stannane, ethyldimethyl-, 1870⁴.
Stannane, tetramethyl-, 1500³, 2622³.
 C_2H_5NO Tetramethylammonium hydroxide,
2092².
 C_2H_5BrLiN , Addn. compd. from $LiBr$ and
 Me_3NH , 2118¹.
 C_2H_5ClLiN , Addn. compd. from $LiCl$ and
 Me_3NH , 2118¹.
 $C_2H_5ClMeNO_2$, 2899¹.
 C_2H_5LiN , Addn. compd. from LiI and $Me-NH$,
2118¹.
 $C_2H_5K_2MoO_7$, 2898⁷.
 $C_2H_5ClO_2$, 2871⁴.
 $C_2H_5BeBrO_4$, 783².
 $C_2H_5BeClO_4$, 783².
 C_2H_5BrLiN , Addn. compd. from $LiBr$ and
 Me_3NH , 2118¹.
 C_2H_5ClLiN , Addn. compd. from $LiCl$ and
 Me_3NH , 2118¹.
- $C_4H_2Mo_2N_2O_9$, 2898⁷.
 $C_4H_2N_{12}S_{11}V_6 + 18H_2O$, 1586⁵.
 $C_4H_2N_{12}S_{11}V_6$ Guanidine perthiovanadate, 4156⁹.
 $C_4H_2Co_2N_{10}O_{10} + 3H_2O$, 1076⁴.
 C_4I_2 Butadiene, diiodo-, 2930⁹.
 $C_4KO_2Sc + 2H_2O$, 2698⁴, 3180⁴.
 $C_4K_2MoN_8S_4 + 2H_2O$, 575².
 $C_4Li_2N_4Pt$ Lithium cyanoplatinite, 2386³.
 $C_4Mo_2O_{11} + 4H_2O$, 2898⁷.
 C_4N_2 Methyl, tricyano-, 1583⁹.
 C_4N_2Na Methanetrinitrile, Na deriv., 1583⁷.
 $C_4Na_2O_2Sc + 3H_2O$, 2698⁴, 3180⁴.
 C_4NiO_4 See *Nickel carbonyl*.
 C_4O_2Sn See *Tin oxalates*.
 C_4O_2Th See *Thorium oxalate*.
 C_4V Vanadium carbide, 3888¹.
 C_4BrFeN_3 Compd. from $BrCN$ and $FeBr_3$,
3868⁴.
 $C_6CeNa_2O_{15} + 12H_2O$, 2673³.
 $C_6Cl_2FeHgO_8$, 351².
 $C_6FeNa_2Na_2O$ Sodium nitroprusside, 573¹, 1836⁷.
 $C_6FeNa_2Na_2OS$, 573².
 C_6FeO_4 See *Iron carbonyl*.
 $C_6H_2Br_2O_3$ Glutaconic anhydride, α, β -dibromo-,
2153⁹.
 $C_6H_2Cl_3N$ Pyridine, 2,3,5-trichloro-, 2182⁷.
 $C_6H_2BrO_2$ Glutaconic anhydride, β -bromo-,
2153⁹.
 $C_6H_2Br_2N$ Pyridine, dibromo-, 1902¹, 2976⁴.
 $C_6H_2BrO_2$ Glutaconic acid, α, β, γ -tribromo-,
2153⁹.
 C_6H_2ClIN Pyridine, 2-chloro-3-iodo-, 1640⁴.
 $C_6H_2ClIN_2O_2$ Pyridine, 2-chloro-5-nitro-, 670³.
 $C_6H_2Cl_2N$ Pyridine, dichloro-, 838⁹, 2182⁹,
2976⁴.
 $C_6H_2Cl_2NO$ 2-Pyridol, 3,5-dichloro-, 2182⁴, P
2189⁹.
 $C_6H_2IN_2O_4$ 2-Pyridol, 5-iodo 3-nitro-, 1641⁴.
 C_6H_2LiNO 2-Pyridol, 3,5-diiodo-, 1641⁴, P 2189⁹.
 C_6H_2 1,3-Pentadiene, 2695⁴.
 $C_6H_2AsClIN$ Pyridine, 3-dichloroarsyl-, 1641¹.
 C_6H_2AsNO Pyridine, 3 arsinoso-, 1641¹.
 C_6H_2BrN Pyridine, 3-bromo-, 1902¹.
 $C_6H_2Br_2O_3$ Glutaconic acid, α, β -dibromo-,
2153⁹.
 C_6H_2ClNO 2-Pyridol, 5-chloro-, 2182⁴, P 2189⁹.
 $C_6H_2ClIN_2O_2$ Pyridine, 2-amino-5-chloro-3-nitro-,
2982⁴.
Pyridine, 5-chloro-2-nitramino-, 2182⁵.
 $C_6H_2Cl_2IN$ Pyridine, 3-iodo-, dichloride, P 612⁷.
 $C_6H_2Cl_2N$ Pyridine, 2-amino-3,5-dichloro-,
2182⁴.
 C_6H_2INO Pyridine, iodoso-, 4267⁴.
2-Pyridol, 5-iodo-, 1686².
2(1) Pyridone, iodo-, 1640^{4,5}.
 $C_6H_2INO_2$ Pyridine, 3-iodo-2-nitramino-, 1640¹.
 $C_6H_2N_2O_2$ Pyridine, 3-nitro-, P 1143⁷.
 $C_6H_2N_2O_2$ 2-Pyridol, 5-nitro-, P 607³.
 $C_6H_2N_2O_3$ Imidazolecarboxylic acid, 1472⁴,
1639⁷.
Orotic acid, 1905¹.
 $C_6H_2N_2O$ See *Hypoxanthine*.
 $C_6H_2N_2O_2$ See *Xanthine*.
 $C_6H_2O_2$ See *2-Furaldehyde*.
 $C_6H_2O_3$ Pyromucic acid, 2968².
 $C_6H_2O_4$ Glutamic acid, 2153⁹.
 $C_6H_2BrO_2$ Glutaconic acid, β -bromo-, 2153⁹.
 $C_6H_2Br_2FeN_3$ Addn. compd. of HCN and
 $FeBr_3$, 3868⁴.
 C_6H_2ClIN Pyridine, 2-amino-5-chloro-, 2182⁵.
 $C_6H_2ClIN_2O_2$ 3-Hydantoinacetyl chloride, 2154⁹.
 C_6H_2ClO Furan, 2-(chloromethyl)-, 5472².
 $C_6H_2Cl_2IN$ Pyridinium dichloroiodide, 3706⁵.

- C₅H₅IN₂: Pyridine, aminoiodo-, P 613¹, 1640⁴, P 2990⁴; *salts*, P 4484².
- C₅H₅N See *Pyridine*.
- C₅H₅NO 2-Pyridol, P 607².
- 2-Pyridone, P 2189².
- 2-Pyrrolealdehyde, 4698⁷.
- C₅H₅NO₂ 2-Furaldehyde, oxime, 3681⁷.
- C₅H₅NO₂S 1-Hydroxypyridinium sulfonic acid, cyclic anhydride, 5159¹.
- C₅H₅N₃ See *Adenine*.
- C₅H₅N₃O See *Guanine*.
- C₅H₅ Cyclopentadiene, 2156⁴, 5304².
- 1-Penten-4-ine, 90⁴.
- C₅H₅AsN Pyridine, 3-arsyl-, 1641⁴.
- C₅H₅AsNO₂ 3-Pyridinearsonic acid, *and*, Cu salt, 1641⁷.
- C₅H₅AsNO₂ Pyridinearsonic acid, hydroxy-, 1686¹, P 1907².
- C₅H₅Br₂ Cyclopentene, dibromo-, 2156⁴.
- 1,3-Pentadiene, 2,3-dibromo-, 2695⁵.
- C₅H₅ClNaO₂ Malonic acid, chloro-, di-Me ester, Na deriv., 3211³.
- C₅H₅Cl₂O₂ Acetic acid, dichloro-, allyl ester, 3661⁴.
- C₅H₅Cl₃NO Valeronitrile, β , β , γ -trichloro- α -hydroxy-, 3661⁴.
- C₅H₅N₂ See *Pyridine, amino-*.
- C₅H₅N₂OS 3 (2)-Imidazo[2,3- β]thiazolone, 5,6-dihydro-, 5184².
- C₅H₅N₂O₂ Thymine, 2445².
- C₅H₅N₂O₂ Malonamic acid, α -cyano-, Me ester, 4193⁴.
- C₅H₅N₂O₂ 1-Hydantoinacetic acid, 3443⁴.
- Uracil, 5 - hydroxy - 6 - (hydroxymethyl) -, 1905⁴.
- C₅H₅O Furan, 2-methyl-, P 609⁴.
- C₅H₅OS 2-Furanmethyl mercaptan, P 155¹, P 1650¹, P 3715², 5472².
- C₅H₅O₂ 2-Furancarbinol, P 609⁴, 2968².
- C₅H₅O₄ 1,1-Cyclopropanedicarboxylic acid, *and di-Na salt*, 4871¹.
- Glutaconic acid, 4673².
- Mesaconic acid, 5163².
- C₅H₅S Thiophene, methyl-, 4114^{1,2}.
- C₅H₅BF₂O₂ Boron acetylacetone difluoride, 2424⁴.
- C₅H₅F₃N₂O₂ Allophanic acid, β -trifluoroisopropyl ester, 4441².
- C₅H₅F₃O 2-Propanol, 1,1-trifluoro-, acetate, 4441¹.
- C₅H₅MoO₃ + 2.5H₂O Molybdenyl acetylacetone, 1877⁴.
- C₅H₅N Semiconitrile, 4443².
- C₅H₅NO₂ Acetic acid, cyano-, Et ester, 3668⁴, 4191³, 4941⁴.
- Succinimide, N-methyl-, 1408².
- C₅H₅NO₂ Glutaramic acid, γ -hydroxy-, γ -lactone, 3668².
- C₅H₅NO₂ Aspartic acid, carboxy-, 728¹.
- C₅H₅N₂ Pyridine, diamino-, P 1416², 1641⁴, P 2723².
- C₅H₅N₂O Cytosine, 5-methyl-, 2445², 3443².
- 2(1)-Pyrimidone, 4-methylamino-, *and* -HCl, 2941².
- C₅H₅N₂OS 1,3,4-Thiodiazolid-2-one, 5-(allylimino)-, 2974⁷.
- C₅H₅N₂O₂ 1,3,4 - Oxidiazole, 2 - acetamido - 5-methyl-, 4471³.
- C₅H₅N₂OS 1,3,4-Thiodiazolid-2-one, 3-acetyl-5-methylimino-, 2974⁷.
- C₅H₅N₂O₂ 3-Hydantoinacetamide, 2154⁴.
- C₅H₅ (See also *Isoprene*.)
- 1,2-Butadiene, 3-methyl-(?), P 2722².
- 2,3-Pentadiene (?), P 2722².
- Piperylene, 2695^{4,7}.
- C₅H₅AsN₂O₂ 3-Pyridinearsonic acid, 6-hydrazino-, 1641⁷.
- C₅H₅BrClO Butyryl chloride, γ - bromo - α - methyl-, 375².
- C₅H₅Br₂O Isovaleryl bromide, α -bromo-, 4463⁴.
- C₅H₅Br₂ Pentane, 1,2,3,4-tetrabromo-, 2695^{4,7}.
- C₅H₅ClNO₂ β -Alanine, N-chloroacetyl-, 1113².
- C₅H₅ClNO₂ 2-Propanol, 1-chloro-1-nitro-, acetate, 372⁴.
- C₅H₅ClN₂O₂Pt, 1582⁴.
- C₅F₅Cl₂O₂ Acetic acid, dichloro-, Pr ester, 3661⁴.
- 2-Propanol, 1,3-dichloro-, acetate, 3013⁴, 4685².
- C₅H₅ClN₂O₂Pt, 1583¹.
- C₅H₅N Imidazole, 1,4-dimethyl-, *chloroaurate*, 4481⁴.
- C₅H₅N₂O₂ Carbamic acid, cyanomethyl-, Et ester, 4930⁷.
- C₅H₅N₂S Thiazole, 4-methyl-2-methylamino-, 101⁴.
- C₅H₅N₂O 4(3)-Pyrimidone, 1,2,5,6-tetrahydro-2,6-diimino-1-methyl-, 3443⁴.
- C₅H₅N₂O₂ Cyanamide, bis(methylcarbamyl), 2699⁴.
- C₅H₅N₂O₂Pt, 1582⁴.
- C₅H₅N₂O₂ Pentaerythritol, tetranitrate, 516⁴, P 2192², 4821².
- C₅H₅N₂S₂ 1,2,3,4-Tetrazole, 5,5'-methylenedithiolbis[1-methyl-, 4470⁴.
- C₅H₅O Δ^1 -3-Pentenone, 4197⁴.
- C₅H₅O₂ Angelic acid, 4438².
- α , α' -Bi(ethylene oxide), β -methyl-, 2696⁷.
- 1,3-Dioxolane, 2-vinyl-, 5468².
- Pentanedione, 1877^{4,5}, 2424³, 3539⁴, 3685⁷, 4197¹, 4941³; *Pr deriv.*, 4140²; *Sm deriv.*, 4139².
- Pentenic acid, 96⁴.
- Pyrotartaraldehyde, 4480⁴.
- Tiglic acid, 4837⁴, 4438².
- C₅H₅O₂ Acetic acid, anhydride with propionic acid, P 3479².
- Carbonic acid, allyl Me ester, 3902⁴.
- Glycidol, acetate, 99².
- Levulinic acid, 1463², 2153⁴, 3941³, 4469⁴.
- 1-Propanol, 1,3-epoxy-, acetate, 4929².
- C₅H₅O₂ (See also *Glutaric acid*.)
- Arabinosane, 2425⁴.
- Malonic acid, dimethyl-, 5162³; *and di-Na salt*, 4871¹.
- , ethyl-, 5162¹; *and di-Na salt*, 4871³.
- C₅H₅O₂ Formin, di-, 1107², 1867², 2696⁴, 3207².
- Glutaric acid, α -hydroxy-, 3667⁴, 5486⁴.
- C₅H₅O₂S Succinic acid, α -methyl- β -sulfo-, *and salts*, 1114^{2,3,4}.
- C₅H₅Br 2-Pentene, bromo-, 2149⁴, 4196^{4,5}.
- C₅H₅BrMgO₂ Carbonic acid, Bu ester, bromomagnesium salt, 4925².
- Carbonic acid, isobutyl ester, bromomagnesium salt, 4925².
- C₅H₅BrO₂ Butyric acid, β -bromo- α -methyl-, 379².
- 1,3-Dioxolane, 2-(β -bromoethyl)-, 2937⁴.
- Propionic acid, α -bromo-, ethyl ester, 2886⁴.
- C₅H₅Cl Pentene, chloro-, 1876², 2416⁴, 4196⁴.
- C₅H₅ClMgO₂ Carbonic acid, Bu ester, chloromagnesium salt, 4925².
- C₅H₅ClO Pivalyl chloride, 2935².
- C₅H₅ClO₂ Acetic acid, chloro-, isopropyl ester, 1326².
- 1,3-Dioxolane, 2-(β -chloroethyl)-, 5468².
- C₅H₅ClO₂ Isovaleric acid, β -chloro- α -hydroxy-, 1616².

- C_5H_9ClS Sulfide, allyl β -chloroethyl, 2417.
 C_5H_7HgN Butane, 1-(cyanomercuri)-, 1871.
 C_5H_7NO 2-Pyrrolidone, 4-methyl-, 819.
 Senecioamide, 4443.
 $C_5H_7NO_2$ (See also *Proline*.)
 1-Pentene, 1-nitro-, 372.
 $C_5H_7NO_3$ Proline, hydroxy-, 1877.
 $C_5H_7NO_4$ (See also *Glutamic acid*.)
 2-Propanol, 1-nitro-, acetate, 372.
 $C_5H_7NO_5$ Glutamic acid, β -hydroxy-, 1877.
 $C_5H_7N_2$ See *Histamine*.
 C_5H_7NiNi Nickel cyanide, compd. with $PrNH_2$, 2418.
 Nickel cyanide, compd. with Me_3N , 2118.
 C_5H_{10} (See also *Butene, methyl*; *Pentene*.)
 Cyclopentane, 2872.
 Cyclopropane, 1,2-dimethyl-, 4196.
 $C_5H_9BrNO_2$ Propionamide, α -bromo-*N*- β -hydroxyethyl-, 1112.
 $C_5H_9Br_2$ Pentane, 1,5-dibromo-, 2150.
 $C_5H_9Br_2Te$ Telluropyran, dibromotetrahydro-, 1787.
 $C_5H_9Cl_2$ Pentane, dichloro-, 454.
 $C_5H_9Cl_2Te$ Telluropyran, dichlorotetrahydro-, 1787.
 $C_5H_9Cl_2O$ Ethyl ether, compd. with CCl_4 , 2641.
 $C_5H_9HgO_2$ Propane, 1-(acetoxymethyl)-, 1871.
 $C_5H_9I_2$ Pentane, 1,5-diiodo-, 817.
 $C_5H_9I_2Te$ Telluropyran, tetrahydrodiiodo-, 1787.
 $C_5H_9I_4Te$ Telluropyran, tetrahydrotetraiodo-, 1787.
 $C_5H_9N_2OS$ Acetamide, α -(*N*-methylacetamido)-thio-, 3470.
 $C_5H_9N_2O_2$ Glyoxime, dimethyl-, Me deriv., 3902.
 $C_5H_9N_2O_3$ (See also *Glutamine*.)
 Alanine, gl. cyl., 157, 1113, 1420, 2698.
 Glutaramide, α -hydroxy-, 3668.
 Glycine, alanyl-, 157, 2698, 5477.
 Hydantoic acid, Et ester, 3442.
 $C_5H_9N_2S$ 1,3-Diazepine-2(3)-one, 4,5,6,7 tetrahydrothio-, 1880.
 C_5H_9O (See also *Pentaneone*.)
 Ether, ethyl propenyl, 2417.
 Ethylene oxide, α -ethyl- α -methyl-, 2694.
 —, trimethyl-, 3908, 4472.
 Mesityl oxide, 4471.
 Pentenol, 1876, 2416, 2695, 4196, 4197.
 Pivalaldehyde, 2420.
 Valeraldehyde, 2483.
 C_5H_9OS Ethanol, 2-(allylmercapto)-, 2417.
 $C_5H_9O_2$ (See also *Isovaleric acid*; *Valeric acid*.)
 Acetic acid, isopropyl ester, P 3932, 4388.
 Pr ester, 10, 5395.
 Butyraldehyde, α -hydroxy- α -methyl-, 2151.
 1,2-Cyclopentanediol, 2095.
 1,3-Dioxolane, 2-ethyl-, 2037.
 Ethanol, 2-(propenyloxy)-, 2937.
 Formic acid, Bu esters, 1326.
 2-Furancarbinol, tetrahydro-, 2968.
 2-Pentanone, hydroxy-, 373, P 3477, 4197.
 Propionic acid, Et ester, P 397.
 Valeric acid, 4442.
 $C_5H_9O_3$ Butyric acid, α -hydroxy- α -methyl-, 4436.
 Carbonic acid, di-Et ester, 1058, 4120.
 m-Dioxane, 6-methoxy-, 99.
 1,3-Dioxolane, 4-(methoxymethyl)-, 99.
 Lactic acid, Et ester, P 846.
 Valeric acid, hydroxy-, 100, 3496; Na salt, 819.
 $C_5H_9O_4$ Acetin, mono-, 1876.
 1,3-Dioxolane, 2- (α , β -dihydroxyethyl)-, 5468.
 $C_5H_{10}O_4$ (See also *Arabinose*; *Xylose*.)
 Apiose, 3875.
 Xyloketo, 4498.
 $C_5H_{10}O_5S$ 2-Propanesulfonic acid, 2-hydroxy-, acetate, Cu salt, 94.
 $C_5H_{10}S_4$ Pentamethylene tetrasulfide, 97.
 $C_5H_{11}AsO_4$ Diglycol methyl arsonate, 596.
 $C_5H_{11}Br$ (See also *Butane, bromomethyl*.)
 Pentane, 1-bromo-, 4440.
 $C_5H_{11}BrHg$ Pentane, 1-(bromomercuri)-, 1870.
 $C_5H_{11}BrMg$ Amylmagnesium bromide, 2934.
 tert-Amylmagnesium bromide, 2934.
 Isoamylmagnesium bromide, 2934.
 n-Methylbutylmagnesium bromide, 2934.
 $C_5H_{11}BrOTe$ Telluropyran, bromotetrahydrohydroxy-, 1787.
 $C_5H_{11}CdN_2S_2$, 3868.
 $C_5H_{11}Cl$ Pentane, chloro-, P 156, 454, 4440.
 $C_5H_{11}ClHg$ Pentane, 1-(chloromercuri)-, 1870.
 $C_5H_{11}ClMg$ *tert*-Amylmagnesium chloride, 1107.
 $C_5H_{11}ClO$ 2-Butanol, 1-chloro-2-methyl-, 2694.
 Ether, butyl chloromethyl, P 612.
 1-Pentanol, 5-chloro-, 2423.
 $C_5H_{11}ClOTe$ Telluropyran, chlorotetrahydrohydroxy-, 1787.
 $C_5H_{11}Cl_2N_2O.Pt$, 1583.
 $C_5H_{11}Cl_2N_2O.Pt$, 1581, 1583.
 $C_5H_{11}Cl_2O$ Ethyl ether, compd. with $CHCl_3$, 2641.
 $C_5H_{11}HgI$ Pentane, 1-(iodomercuri)-, 1870.
 $C_5H_{11}HgNO_2$ Pentane, 1-(hydroxymethyl)-, nitrate, 1871.
 $C_5H_{11}I$ Pentane, 1-iodo-, 4440.
 $C_5H_{11}IOTe$ Telluropyran, tetrahydrohydroxyiodo-, 1787.
 $C_5H_{11}IO_2$ 1-Propanol, 2-ethoxy-3-iodo-, P 3234.
 $C_5H_{11}ISe$ Selenophene, 2,3,4,5-tetrahydro-, methiodide, 3704.
 $C_5H_{11}KN_2$ Valeramide, K salt, 506.
 $C_5H_{11}N$ (See also *Piperidine*.)
 Butenylamine, methyl-, 3052.
 Pyrrolidine, 3-methyl-, 1634.
 $C_5H_{11}NO$ Propionaldehyde, β -ethylamino-, 3209.
 $C_5H_{11}NO_2$ (See also *Amyl nitrite*; *Betaine*; *Valine*.)
 Carbamic acid, Bu ester, 2154.
 Ethanol, methylamino-, acetate, P 242.
 Norvaline, 1618, 2635, 3901.
 Valeric acid, amino-, 1027.
 $C_5H_{11}NO_3S$ Butyric acid, aminomethylmercapto-, 1617, 3941.
 $C_5H_{11}NO_4$ Glycine, α -glyceride, 4673.
 $C_5H_{11}N_2O_2$ Biuret, 1-propyl-, 3442.
 $C_5H_{11}O_2P$ Phosphoribonic acid, 1646.
 C_5H_{12} See *Butane, methyl*; *Pentane*.
 $C_5H_{12}CdCl_2S_2$, 3868.
 $C_5H_{12}ClNO_2$ (Carboxymethyl) trimethylammonium chloride, 3023.
 $C_5H_{12}HgO$ Pentane, 1-(hydroxymethyl)-, 1870.
 $C_5H_{12}N_2$ Cyclopentanediimine, 573.
 $C_5H_{12}N_2O$ Urea, butyl-, 3442.
 Urea, α , α -diethyl-, 3442.
 $C_5H_{12}N_2O_3$ Carbamic acid, (β -aminoethyl)-, Et ester, 2183.
 Ornithine, 1877, 3481.
 Propionamide, α -amino-*N*- β -hydroxyethyl-, and *HBr*, 1112.
 $C_5H_{12}N_2O_4$ Ornithine, γ -hydroxy-, 4216.
 $C_5H_{12}N_2S$ Pseudourea, tetramethylthio-, 1115.
 Urea, tetramethylthio-, 1115.

- C₅H₁₃N₅S₂ Carbamic acid, (δ -aminobutyl)dithio-, 1880⁹.
 C₅H₁₃N₅O₂ Aceturic acid, guanidine salt, 1621⁹.
 C₅H₁₃N₅O₂S₂ Methionamide, *N*, *N'*-diethyl-*N*, *N'*-dinitro-, 98⁹.
 C₅H₁₃N₅S₂ Pseudourea, β -ethyl- α -guanyl- γ -methylthio-, -H Br, 4931³.
 C₅H₁₃O₂ (See also *Amyl alcohol*; *Isoamyl alcohol*.)
 2-Pentanol, 1876⁹, 4192⁴, 4208⁹.
 1-Propanol, dimethyl-, 10⁴, 2420⁴.
 C₅H₁₃O₂ Pentanediol, 817⁷, 4197¹.
 C₅H₁₃O₂Te Telluropyran, tetrahydrodihydroxy-, 1787².
 C₅H₁₃O₂ Propanol, dimethoxy-, 4445⁴.
 C₅H₁₃O₂ See *Pentaerythritol*.
 C₅H₁₃ClN₅O (Carbamylmethyl)trimethylammonium chloride, 3023¹.
 C₅H₁₃N₅ Amylamine, 4270⁴; *hydrohalides*, 2083⁴.
 C₅H₁₃N₅O Butylamine, γ -methoxy-, 4669⁴.
 1-Pentanol, δ -amino-, 2938³.
 C₅H₁₃N₅O₂ (See also *Muscarine*.)
 1-Propanol, 2-methoxy-3-methylamino-, P 3234¹.
 C₅H₁₃N₅O₂S₂ Methanesulfonamide, *N*, *N*-diethyl-, 2427⁴.
 C₅H₁₃N₅O₂S₂ Choline, sulfate, 3023¹.
 C₅H₁₃N₅O₂ Guanidine, ethyl- α , α -dimethyl, P 5194⁴.
 C₅H₁₃N₅ Biguanide, α -propyl- α -H₂SO₄, 4931³.
 Biguanide, α , α , β -trimethyl-, -H Br, 4931³.
 C₅H₁₃AsN₅O₂ 1-Propanearsonic acid, 3-dimethylamino-, and -HCl, 92⁷.
 C₅H₁₃ClN₅O₂ + H₂O, 1583⁴.
 C₅H₁₃N₅ Cadaverine, 2939¹.
 C₅H₁₃N₅O₂S₂ Methionamide, *N*, *N'*-diethyl-, 98⁹.
 C₅H₁₃N₅ Guanidine, α , α' -trimethylenbis-, and salts, 1881¹.
 C₅H₁₃N₅O₂S₂ Urea, guanythio-, carbonate, 4931³.
 C₅H₁₃Sn Stannane, ethyltrimethyl-, 1870⁹.
 C₅H₁₃AsClN₅O₂ (β -Arsonoethyl)trimethylammonium chloride, 92⁷.
 C₅H₁₃AsN₅O₂ + 1/2O₂ Ethanearsonic acid, 2,2'-methyliminobis-, 92⁷.
 C₅H₁₃As₂ Pentarsenole, tetrahydropentamethyl-, 120³.
 C₅H₁₃N₅O₂ See *Choline*.
 C₅H₁₃N₅O₂P₂ Pyrophosphoric acid, di-Et ester, guanidine salt, 2418⁹.
 C₅H₁₃BrLiN₅ Addn. compd. from LiBr and MeNH₂, 2118⁷.
 C₅H₁₃LiLiN₅ Addn. compd. from LiI and MeNH₂, 2118⁷.
 C₅H₁₃O₂Th + 12H₂O, 2673⁹.
 C₅Ag₂IK₂N₅S₂, 5429⁴.
 C₅Ag₂IK₂N₅S₂ Sodium argentoiodothiocyanate, 5429⁴.
 C₅Ag₂OsN₅ + 3H₂O Cerium argentocyanide, 4902⁹.
 C₅Ag₂OsN₅ + 5H₂O Lanthanum argentocyanide, 4902⁹.
 C₅Ag₂OsN₅ + 3H₂O Neodymium argentocyanide, 4902⁹.
 C₅Ag₂OsN₅ See *Silver ferrocyanide*.
 C₅As₂OsN₅ + 3H₂O Cerium aurocyanide, 4902⁹.
 C₅As₂OsN₅ + 3H₂O Lanthanum aurocyanide, 4902⁹.
 C₅As₂OsN₅ See *Barium ferrocyanide*.
 C₅Br₂ Benzene, hexabromo-, 4936⁹.
 C₅Cl₂O₂ Quinone, tetrachloro-, 4896⁴, 4937⁹.
 C₅Cl₂ Benzene, hexachloro-, 757⁷.
 C₅Os₂Os₂Fe₂ + 3H₂O, 2900⁴.
 C₅Os₂ Chromium carbonyl, 2689⁹.
 C₅Os₂Os₂ See *Chromium oxalate*.
 C₅Os₂FeN₅ See *Copper ferrocyanide*.
 C₅Fe₂KN₅Pb + 3H₂O, 2900⁴.
 C₅Fe₂KN₅ See *Potassium ferricyanide*.
 C₅Fe₂K₂O₂ Potassium ferrioxalate, 5111⁷.
 C₅Fe₂K₂N₅ See *Potassium ferrocyanide*.
 C₅Fe₂Li₂N₅ See *Lithium ferricyanide*.
 C₅FeN₅ + 2H₂O, 2900⁴.
 C₅FeN₅Na₂ See *Sodium ferrocyanide*.
 C₅FeN₅O₂Pb₂ + 5 1/2 H₂O, 2900⁴.
 C₅Fe₂O₂ See *Iron oxalates*.
 C₅Os₂Os₂ + 4H₂O Gallium oxalate, 5425⁴.
 C₅HBr₂N₅O₂ Benzene, 2,3,4-tribromo-1,5-dinitro-, 1890¹.
 C₅HCl₃N₅O₂ Benzene, 2,3,4-trichloro-1,5-dinitro-, 1891¹.
 C₅HCl₂O₂ Quinone, trichloro-, 4896⁴.
 C₅HCl₂O Phenol, pentachloro-, 5173³.
 C₅HI Hexatriene, iodo-, 2931¹.
 C₅H₂Br₂ClNO Isonicotinyl chloride, 2,6-dibromo-, 2976⁴.
 C₅H₂ClN₅O₂ Picryl chloride, 2349³, 3214³.
 C₅H₂Cl₂N₅ Isonicotinonitrile, 2,6-dichloro-, 2976⁴.
 C₅H₂Cl₃F Benzene, 1,2,4-trichloro-5-fluoro-, 5170³.
 C₅H₂Cl₃KN₅O Aniline, 2,4,5 (and 2,4,6) trichloro-*N*-nitroso-, K deriv., P 2190⁴.
 C₅H₂Cl₂N₅O Isonicotinyl chloride, 2,6-dichloro-, 2976⁴.
 C₅H₂Cl₂N₅O₂ Picolinic acid, trichloro-, 839⁴.
 C₅H₂Cl₂ Benzene, tetrachloro-, 757⁷.
 C₅H₂Cl₂O Phenol, tetrachloro-, 5173³.
 C₅H₂Cl₂O₂ 1,3,5-Benzenetrisulfonyl chloride, 2-chloro-, 1630⁴.
 C₅H₂Cl₂Fe₂Os₂ + 14H₂O Iron oxalate perchlorate, 2116².
 C₅H₂Hg₂N₅O₂ *p*-Benzenone, 2-(hydroxymercuro-4-isonitro-6-nitro-, 2,4-anhydride, 3216³.
 C₅H₂N₅O₂ Aniline, 2,3,4,5,6-pentanitro-, 52⁴.
 C₅H₂Ag₂IK₂Na₂S₂, 5429⁴.
 C₅H₂Br₂ClN₅NaO Aniline, 5-bromo-2-chloro-3-nitroso-, Na deriv., P 2190⁴.
 C₅H₂Br₂Cl₂Hg₂ Benzene, 1-bromo-2,4-bis(chloromercuro-), 3216³.
 C₅H₂Br₂ClN₅ 2,5-Dibromobenzenediazonium chloride, 4456⁴.
 C₅H₂Br₂N₅O₂ Benzene, 1,4-dibromo-2-nitro-, 2171⁴.
 Isonicotinic acid, 2,6-dibromo-, 2976⁴.
 C₅H₂Br₂ClN₅ Aniline, 2,4,6-tribromo-3-chloro-, 4456⁴.
 C₅H₂Br₂N₅O₂ Aniline, 2,3,6-tribromo-4-nitro-, 4198¹.
 C₅H₂Br₂O Phenol, tribromo-, 5405⁴.
 C₅H₂Br₂O Resorcinol, tribromo-, 1401⁴.
 C₅H₂Br₂O Compd., m. 122°, from 6-hydroxy-2-keto-1,2-pyran-4-carboxylic acid and Br, 1879⁹.
 C₅H₂Cl₂Hg₂O₂ Phenol, chlorobis(hydroxymercuro-), anhydride, 3216³.
 C₅H₂Cl₂IK₂NaO₂ 1-Phenol-2-sulfonic acid, 4-chloro-6-nitro-, K deriv., and K⁺, 826⁴.
 C₅H₂Cl₂O₂ Benzendiazole, chloro-, P 714⁷.
 C₅H₂Cl₂N₅O₂ Benzene, 1-chloro-2,4-dinitro-, 1890¹.
 C₅H₂Cl₂O₂ Benzendiazolesulfonic acid, chloro-, P 310⁴.
 C₅H₂Cl₂F Benzene, dichlorodifluoro-, 5169³.
 C₅H₂Cl₂IK₂NaO₂ Aniline, 3,4-dichloro-*N*-nitroso-, K deriv., P 319⁴.
 C₅H₂Cl₂NO Nicotinyi chloride, 5-chloro-, 839⁴.
 Picotinyi chloride, 4-chloro-, 839⁴.

- $C_6H_5Cl_2NO_2$ Benzene, 1,2-dichloro-4-nitro-, 1173.
 Isonicotinic acid, dichloro-, 838², 2976⁴.
 Picolinic acid, 4,6-dichloro-, 838².
 $C_6H_5Cl_2NO_2$ Phenol, dichloronitro-, 2957⁴.
 $C_6H_5Cl_2O_2S$ Benzenesulfonic acid, 2,5-dichloro-3-nitro-, *K* salt, 826².
 $C_6H_5Cl_2Hg$ Benzene, 1,4-dichloro-2-(chloromercuri)-, 5172².
 $C_6H_5Cl_3O$ Phenol, trichloro-, 2957⁴, 5173⁴.
 $C_6H_5Cl_3O_2S$ *m*-Benzenedisulfonyl chloride, 4-chloro-, 1630⁴.
 $C_6H_5Cl_3O_2S$ 1-Phenol-2,4,6-trisulfonyl chloride, 1630⁴.
 $C_6H_5Cl_3O_2$ Parachloral, 817².
 $C_6H_5Hg_2NO_2$ *o*-Benzeneone, 4,6-bis(hydroxymercuri)-2-isonitro-, 2,4-anhydride, 3216⁴.
p-Benzeneone, 2,6-bis(hydroxymercuri)-1-isonitro-, 2,4-anhydride, 3216⁴.
 $C_6H_5J_2O_2$ Benzene, 1-iodoxy-2,1-dinitro-, 5170².
 $C_6H_5N_2NaO_2$ Nicotinic acid, 6-hydroxy-5-nitro-, *Na* deriv., *Na* salt, 1641⁴.
 $C_6H_5N_2O_2$ (See also *Benzene, trimitro*.)
 Triaznetricarboxylic acid, salt-, 4904⁴.
 $C_6H_5N_2O_2$ See *Phenic acid*.
 $C_6H_5N_2O_2$ Cresol, trimitro-, 2349².
 Styphnic acid, 2349².
 $C_6H_5BrClHg$ Benzene, 1-bromo-4-(chloromercuri)-, 5172².
 C_6H_5BrFO Phenol, 2-bromo-3-fluoro-, 5177².
 C_6H_5BrI Benzene, bromoiodo-, 4197⁴.
 $C_6H_5BrNO_2$ Benzene, bromonitro-, 2171⁴, 4856².
 $C_6H_5BrNO_2S$ Benzenesulfonic acid, 4-bromo-2-nitro-, 4459², 4460², salt-, 4159².
 $C_6H_5Br_2$ See *Benzene, dibromo*-.
 $C_6H_5Br_2NO_2$ Isonicotinamide, 2,6-dibromo-, 2976⁴.
 $C_6H_5Br_2NO_2$ Aniline, 2,4-dibromo-*N*-nitro-, 3675⁴.
 C_6H_5ClHgI Benzene, 1-(chloromercuri)-4-iodo-, 5172².
 $C_6H_5ClHgNO_2$ Benzene, 1-(chloromercuri)-4-nitro-, 5172².
 $C_6H_5ClKNO_2$ Aniline, *m*-chloro-*N*-nitroso-, *K* deriv., *P* 2190⁴.
 C_6H_5ClNO Isonicotinyl chloride, 838².
 Nicotinyl chloride, 838².
 $C_6H_5ClNO_2$ (See also *Benzene, chloronitro*.)
 Isonicotinic acid, 3-chloro-, 838².
 Picolinic acid, 4-chloro-, 838².
 $C_6H_5ClNO_2S$ Benzenesulfonyl chloride, nitro-, 830², 4680².
 $C_6H_5ClNO_2S$ Benzenesulfonic acid, chloronitro-, *P* 1410², 4459², 4460², salt-, 4459².
 $C_6H_5Cl_2$ See *Benzene, dichloro*-.
 $C_6H_5Cl_2FN$ Aniline, 2,4-dichloro-3-fluoro-, 5170².
 $C_6H_5Cl_2Hg$ Benzene, 1-chloro-4-(chloromercuri)-, 5172².
 $C_6H_5Cl_2N_2O$ Isonicotinamide, 2,6-dichloro-, 2976⁴.
 Picolinamide, 4,6-dichloro-, 838².
 $C_6H_5Cl_2O$ Phenol, 2,4-dichloro-, 5173⁴.
 $C_6H_5Cl_2O_2$ Hydroquinone, 2,6-dichloro-, 599².
 Resorcinol, 4,6-dichloro-, 2219².
 $C_6H_5Cl_2O_2S$ 1-Phenol-2,4-disulfonyl chloride, 1630⁴.
 $C_6H_5Cl_3N$ Aniline, trichloro-, 4896⁴, 4937².
 $C_6H_5CoCa_2O_2Pb$, 3900².
 $C_6H_5CoN_2O_2PbTi$, 3900².
 $C_6H_5CaFeN_2O_2Pb$, 3900².
 $C_6H_5FeN_2$ See *Hydroferrocyanic acid*.
 $C_6H_5FeN_2O_2PbTi$, 3900².
 $C_6H_5Hg_2N_2O_6 + H_2O$ Tartaric acid, *Hg* salt, *Hg*(CN)₂ comp., 1115².
 $C_6H_5INO_2$ Picolinic acid, 4-iodo-, and -*HI*, 838².
 $C_6H_5I_2$ See *Benzene, diiodo*-.
 $C_6H_5I_2O_2S$ Phenolsulfonic acid, diiodo-, *Pb* salt, 2629².
 $C_6H_5N_2O_2$ See *Lysine*.
 $C_6H_5N_2O_2$ See *Benzene, dinitro*-.
 $C_6H_5N_2O_2$ (See also *Phenol, dinitro*.)
 Nicotinic acid, 6-hydroxy-5-nitro-, 1641⁴.
 $C_6H_5N_2O_2S$ Benzenesulfonic acid, 2,4-dinitro-, 4459², 4460², salt-, 4459².
 $C_6H_5N_2S$ Benzothiadiazole, 4227².
 $C_6H_5N_2O_2$ Picramide, 3214².
 $C_6H_5N_2O_2S$ Styphnic acid, 5-amino-, 823².
 C_6H_5O See *Quinone; o-Quinone*.
 $C_6H_5OPbS_2$ Resorcinol, 4,6-dimercapto-, *Pb* deriv., 8261².
 $C_6H_5O_2$ 3-Furanacetic acid, 2,5-dihydro-2,5-diketo-, 1878².
 1,2-Pyran-4-carboxylic acid, 6-hydroxy-2-keto-, 1878².
 $C_6H_5AsBrNO_2$ Benzenearsonic acid, 3-bromo-4-hydroxy-5-nitro-, 1400².
 $C_6H_5AsClNO_2$ Benzenearsonic acid, 4-chloro-3-nitro-, and salts, 2954².
 C_6H_5AsCl Arsinic, dichlorophenyl-, 3874².
 $C_6H_5AsI_2NO_2$ Phenol, 2-amino-4-diiodoarsyl-6-nitro-, -*HI*, 119².
 C_6H_5Br See *Benzene, bromo*-.
 C_6H_5BrMg Phenylmagnesium bromide, 2158², 2703², 2934², 3909², 4442², 4682², 5182².
 C_6H_5BrO See *Phenol, bromo*-.
 $C_6H_5BrN_2$ Hydrazine, (2,4,6-tribromophenyl)-, 824².
 C_6H_5BrSn Stannane, tribromophenyl-, 5172².
 C_6H_5Cl See *Benzene, chloro*-.
 C_6H_5ClFN Aniline, chlorofluoro-, 5170².
 C_6H_5ClHg Benzene, (chloromercuri)-, 5172².
 C_6H_5ClHgO Phenol, *p*-(chloromercuri)-, 5172².
 C_6H_5ClHg Phenylmagnesium chloride, 4188².
 $C_6H_5ClN_2O$ Nicotinamide, 5-chloro-, 838².
 $C_6H_5ClN_2O_2S$ Benzenesulfonamide, 4-chloro-2-nitro-, 1629².
 C_6H_5ClO See *Phenol, chloro*-.
 C_6H_5ClN Aniline, 2,4-dichloro-, *P* 2986¹.
 C_6H_5ClNO Phenol, 4-aminodichloro-, 3910², 3911².
 $C_6H_5Cl_2P$ Phosphoryl chloride, 2896².
 $C_6H_5Cl_3N_2$ Hydrazine, (2,4,6-trichlorophenyl)-, 824², 4679².
 $C_6H_5Cl_3OSi$ Silicane, trichlorophenoxy-, 4457⁴.
 $C_6H_5Cl_3Si$ Silicane, trichlorophenyl-, 4457⁴.
 $C_6H_5Cl_3Sn$ Stannane, trichlorophenyl-, 5172².
 C_6H_5F See *Benzene, fluoro*-.
 C_6H_5FO Phenol, *m*-fluoro-, 5176².
 C_6H_5HgI Benzene, (iodomercuri)-, 5172².
 $C_6H_5HgIN_2$ Benzenediazonium iodide, *HgI* salt, 3214².
 C_6H_5I See *Benzene, iodo*-.
 C_6H_5IO (See also *Phenol, iodo*.)
 Benzene, iodoso-, 311².
 $C_6H_5IO_2$ Benzene, iodoxy-, 311².
 $C_6H_5I_2Sn$ Stannane, triiodophenyl-, 5172².
 C_6H_5N Benzeneimine, -*HCl*, 1125².
 C_6H_5NO (See also *Benzene, nitroso*.)
 2-Furanacetoneitrile, 5472².
 C_6H_5NOS Thiocyanic acid, dimethyl ester, 5472².
 $C_6H_5NO_2$ (See also *Benzene, nitro* : Isonicotinic acid; Nicotinic acid; Picolinic acid.)
 Phenol, *o*-nitro-, 3924².
 Quinone, 2-amino-, 1125².

- C₆H₅NO₂** (See also *Phenol, nitro-*)
 Isonicotinic acid, 3-hydroxy-, 888⁷.
 Nicotinic acid, 6-hydroxy-, 1641⁴.
 Quinone, 2-amino-3-(and 5)-hydroxy-, 1125¹.
C₆H₅NO₂S Benzenesulfonic acid, nitro-, 4459^{1,3}, 4460²; *salts*, 4459^{2,7}.
C₆H₅N, Nicotinonitrile, 6-amino-, 1641⁴.
C₆H₅NO, Aniline, 2,4-dinitro-, 3214².
 Nicotinic acid, 6-amino-5-nitro-, 1641⁴.
 —, 6-nitramino-, and *Na salt*, 1641⁴.
C₆H₅ (See also *Benzene*.)
 Acetylene, trimer, *b. n.* —10°, 3437⁸.
 Bipropargyl, 3437⁸.
 1,5-Hexadien-3-ine, 3437⁸.
 1,4-Pentadiene, 3-methyl-, 3437⁸.
C₆H₅AsBrO₂ Benzenearsonic acid, *o*-bromo-, 3447⁸.
C₆H₅AsBrO₂ Benzenearsonic acid, 3-bromo-4-hydroxy-, 3677⁴.
C₆H₅AsCl₂NO Phenol, 4-amino-2-dichloroarsyl-, -HCl, 119⁹.
C₆H₅AsI₂NO Phenol, aminodiiodoarsyl-, -HI, 119⁹.
C₆H₅AsNO Aniline, *p*-aminoso-, P 1649⁷.
C₆H₅AsNO₂ Phenol, aminoarsinoso-, P 1649⁷; *salts*, 119⁹.
C₆H₅AsNO₂ Benzenearsonic acid, hydroxynitro-, 3216¹, 4411³, 4940¹.
C₆H₅BrHgN Aniline, *p*-(bromomercuri)-, 1888¹.
C₆H₅BrN Aniline, bromo-, 3445⁴, 4198¹.
C₆H₅BrNO Phenol, aminobromo-, and -HCl, 599¹.
C₆H₅BrN₂O Hydrazine, (2-bromo-4-nitrophenyl)-, 3680⁸.
C₆H₅BrN₂ Hydrazine, (dibromophenyl)-, 1400⁸.
C₆H₅Br₂O Tricarballylic acid, α,β -dibromo-, 1878⁷.
C₆H₅ClN Aniline, chloro-, 3445⁴.
C₆H₅ClNO Phenol, aminochloro-, and -HCl, 599¹.
C₆H₅ClNO₂S Benzenesulfonic acid, 2-amino-4-chloro-, 4459¹.
C₆H₅ClNO₂ Hydrazine, (chloronitrophenyl)-, 139⁹, 467⁹.
C₆H₅ClN₂ Hydrazine, (2,4-dichlorophenyl)-, 467⁹.
C₆H₅HgIN Aniline, *p*-(iodomercuri)-, 1888¹.
C₆H₅IN Aniline, *p*-iodo-, 3445⁴.
C₆H₅INO Phenol, aminoiodo-, and -HCl, 599¹.
 Pyridine, iodo-2-methoxy-, 1640².
C₆H₅INa Aniline, *Na* deriv., P 1418¹.
C₆H₅N, Malononitrile, isopropylidene-, 1114⁴.
C₆H₅N₂O (See also *Aniline, nitro-*)
 Nicotinic acid, 6-amino-, nitrate, 1641⁴.
 Urocanic acid, 3630⁸.
C₆H₅N₂O₂S Phenyl mercaptan, 2-amino-4-nitro-, 3468⁸.
C₆H₅N₂O, Hydroxylamine, β -(*m*-nitrophenyl)-, 1120¹.
 Phenol, 2-amino-4-nitro-, 1399⁹.
 Pyridine, 2-methoxy-3-nitro-, 1640².
C₆H₅N₂O, Imidazolecarboxylic acid, 2-methyl-, 1472³, 1630⁸.
 3,4-Pyrazolecarboxylic acid, 5-methyl-, 3704⁸.
C₆H₅N₂O₂, 2,4(3,5)-Thiazolidione, 2-azine, 8163¹.
C₆H₅N₂O, Hydrazine, (2,4-dinitrophenyl)-, -HCl, 3941⁷.
C₆H₅N₂O, See "ammonium salt" under *Picric*.
C₆H₅O (See also *Phenol*.)
 Furan, vinyl-, 2064².
C₆H₅OS Ketone, methyl thienyl, 1400⁸.
- C₆H₅O**, See *Hydroquinone*; *Pyrocatechol*; *Quinol*; *Resorcinol*.
C₆H₅O₂S, Resorcinol, 4,6-dimercapto-, 826¹.
C₆H₅O₂S, Resorcinol, trimercapto-, 826¹.
C₆H₅O (See also 1,2,4-Benzenetriol; *Phloroglucinol*; *Pyrogallol*.)
 1,2-Cyclopropanedicarboxylic anhydride, 1-methyl-, 3704⁸.
 Furaldehyde, hydroxymethyl-, 1065⁴, 3030⁸.
 2-Furanacetic acid, 5472⁸.
C₆H₅O₂S See *Benzenesulfonic acid*.
C₆H₅O, Pyromucic acid, hydroxymethyl-, 2175⁹.
 1,4-Pyrone, 5-hydroxy-2-(hydroxymethyl)-, 1882¹, 4906⁹.
C₆H₅O₂S *p*-Phenolsulfonic acid, 1739⁴.
 Phenylsulfuric acid, 3938⁷.
C₆H₅O, Pyromucic acid, tetrahydridic acid, methyl-, 872⁸.
C₆H₅O, Aconitic acid, 4933⁸ and *salts*, 1878⁸.
C₆H₅S Phenyl mercaptan, 36⁸.
C₆H₅AsBrNO₂, *m* Arsanilic acid, 5-bromo-4-hydroxy-, 1400⁸.
C₆H₅AsCl₂N₂O Phenol, 2,6-diaminodichloroarsyl-, *di*-HCl, 119⁹.
C₆H₅AsI₂N₂O Phenol, 2,6-diamino-4-diiodoarsyl-, *di* HI, 119⁹.
C₆H₅AsNNaO, See *Atoxyl*.
C₆H₅AsN₂O, Arsanilic acid, 3-nitro-, 4940¹.
C₆H₅AsN₂O, Arsanilic acid, 3-hydroxy-5-nitro-, 842⁸.
C₆H₅AsO Phenol, *p* arsyl-, 4940¹.
C₆H₅AsO, Benzenearsonic acid, hydroxy-, 1184411³, 4940¹.
C₆H₅AsO, Benzenearsonic acid, dihydroxy-, 2429⁹, 3677⁴.
C₆H₅AsO, *d* Tartaric acid arsonacetic acid, 596¹.
C₆H₅ClN, *m* Phenyleuridine, 4-chloro-, *ZnCl₂ salt*, P 2722⁹.
C₆H₅ClO, 3,3-Butenol, trichloroacetate, 2695¹.
 Crotonyl alcohol, trichloroacetate, 2695¹.
C₆H₅N See *Aniline*; *Picoline*.
C₆H₅NO (See also *Phenol, amino-*)
 Ketone, methyl 2-pyrryl, *compd. with* *o*-tetrahalides, 2068⁷.
 2(1)-Pyridone, 1-methyl-, -HBr, 3022⁹.
C₆H₅NO, 1,2-Cyclobutanedicarboximide, 242⁷.
C₆H₅NO₂S Benzenesulfonic acid, *o*-amino-, 4880⁸.
 Metanilic acid, 1399⁴.
 Sulfanilic acid, 789⁴, 1399⁴.
C₆H₅NO₂S Phenol, *p*-amino-, *H₂ sulfate*, 5159⁹.
 Phenolsulfonic acid, amino-, 1399⁴.
 Phenylsulfuric acid, amino-, and *K salt*, 2160⁷.
C₆H₅NS Phenyl mercaptan, *o*-amino-, 4415⁹.
C₆H₅N₂O Pyridine, 2-methylnitrosoamino-, 8⁹.
C₆H₅N₂O + H₂O Nicotinic acid, 5,6-diamino-, 1641⁴.
C₆H₅NO₂S 1,3,4-Thiadiazolid-2-one, 3,4-di-acetyl-5-imino-, 2074⁸.
C₆H₅N₂O₂S Benzenesulfonic acid, *o*-nitro-, hydrazide, 3665¹.
C₆H₅O₂P Phosphoric acid, mono-Ph ester, *Et salt*, 2418⁹.
C₆H₅ Cyclohexadiene, 2156⁴.
C₆H₅AsN Arsanilic acid, (*p*-aminophenyl)-, -HCl, 4940¹.
C₆H₅AsNO₂ See *Arsanilic acid*.
C₆H₅AsNO₂, Arsanilic acid, hydroxy-, P 849⁹.
 P 849⁹.
C₆H₅Br, Cyclohexane, dibromo-, 2156⁴.
 2,4-Hexadiene, 3,4-dibromo-, 2695¹.

- C₆H₅BrN₂** Compd., m. 150°, from bromination of 2,3-dimethylquinoxaline, 2978¹.
- C₆H₅Br**, 2-Hexene, 2,3,4,5-tetrabromo-, 2695².
- C₆H₅ClN₂O₂Fe**, 1581¹.
- C₆H₅Cl₂N₂Zn**, 4420².
- C₆H₅Cl₂O** Compd. from C₆H₅ and HClO, 1399¹.
- C₆H₅Cl₂S** Ethane, 1-(β-chloroethylmercapto) 2 (trichlorovinylmercapto), 2933².
- C₆H₅JN** 1-Methylpyridinium iodide, 1902¹.
- C₆H₅NO₂Sb** Benzenesulfinic acid, *p*-amino-, 599².
- C₆H₅N₂** (See also *Hydrazine, phenyl-*; *Phenylene diamine*.)
Pyridine, 1,2-dihydro-2-imino-1-methyl-, -HCl, 1640².
—, 2-methylamino-, 837².
Pyrrole, 2-(methyliminomethyl)-, 469².
- C₆H₅N₂O** Phenol, diamino-, 462².
2-Pyrazinol, 3,6-dimethyl-, 602², 3172².
Pyridine, 3-amino-2-methoxy-, 1610².
- C₆H₅N₂O₂** Hydroquinone, diamino-, 2130².
2-Imidazolecarboxylic acid, Et ester, 1638².
Pyrrolecarboxylic acid, Et ester, 3701².
Pyrimidine, 2,4-dimethoxy-, 3930².
2(1)-Pyrimidone, 4-methoxy-1-methyl-, 3930².
- C₆H₅N₂S** Phenyl mercaptan, *o*-hydrazino-, 3443².
- C₆H₅N₂Se** Selenocyanate, tetramethylene- α , δ di-, 3704².
- C₆H₅O** Δ^2 -Cyclohexanone, 1197¹.
Ketone, m. 170-2°, from 3-isomoxycyclohexanone, 1131².
- C₆H₅OS** 2-Furanmethylmercaptan, methyl-, P 155¹.
- C₆H₅O₂** See *Sorbic acid*.
- C₆H₅O₂S** 2-Furancarbinol, 5-(mercaptomethyl)-, P 155¹.
- C₆H₅O₃** 1,1-Cyclobutanedicarboxylic acid and di-Na salt, 4871².
1,2-Cyclopropanedicarboxylic acid, 1-methyl-, 3704².
Fumaric acid, di-Me ester, 1059².
—, dimethyl-, 385².
Maleic acid, di-Me ester, 1059².
—, dimethyl-, 385².
- C₆H₅O₄** Rhamnolactone, 5 keto-, 1881².
- C₆H₅O₅** 1,1,2-Propanetricarboxylic acid, 1111².
- C₆H₅O₇** See *Citric acid*.
- C₆H₅AlO₃** See *Aluminum acetate*.
- C₆H₅AsN₂O₂** Benzenearsonic acid, 3,4-diamino-, P 849².
- C₆H₅BrO₂** Propionic acid, α bromo-, allyl ester, 500².
- C₆H₅BrO₃** Succinic acid, bromo-, di-Me ester, 2720².
- C₆H₅Cl** Cyclohexene, 3-chloro-, 4197¹.
- C₆H₅ClO** Pentaoyl chloride, methyl-, 96².
- C₆H₅ClO₂** 1,3-Dioxolane, 2-(α -chloropropenyl)-, 1402².
- C₆H₅ClO₃** Succinic acid, chloro-, di-Me ester, 2154².
- C₆H₅N** Crotononitrile, α , β -dimethyl-, 4443².
Pyrrole, 2,4-dimethyl-, compd. with SnCl₄, 2969².
—, 2-ethyl-, 5189².
- C₆H₅NO** Cyclobutanecarboxylic acid, 2-(amino-methyl)-, cyclic lactam, 2427².
2(3)-Pyrrolone, 1,5-dimethyl-, 4469².
- C₆H₅NO₂** Glutamic acid, carboxy-, 728².
- C₆H₅N₂** Hydrazine, (*o*-aminophenyl)-, 370².
Pyridine, 2- α -methylhydrazino-, 837².
- C₆H₅N₂OS** Δ^2 -1-Pyrazolinecarboxamide, 5-keto-N,3-dimethylthio-, 388².
- C₆H₅N₂O₂** (See also *Histidine*.)
Cupferron, 1841².
Resorcinol, 2,4,6-triamino-, 2430¹.
- C₆H₅N₃** s-Triazine, 1,4-*endo*-methylene-2-dimethylamino-6-imino-, -HCl, 4931¹.
- C₆H₅N₃O₂** 2,4(1,3)-s-Triazinedione, 5,6-dihydro-1-methyl-6-(methylcarbamyylimino)-, 2699².
- C₆H₅O₂TI** Acetoacetic acid, Et ester, TI deriv., 2123².
- C₆H₅O₂Sm** Samarium acetate, 4139¹.
- C₆H₆** (See also *Cyclohexene*.)
Biallil, 3898².
Butadiene, dimethyl-, 5090².
Cyclopropane, isopropenyl-, 4935².
Hexadiene, 2695², 3207¹, 3436².
Hexene, 90², 4925².
Pentadiene, methyl-, 2848¹, 4935².
1-Pentene, 3-methyl-, 4925¹.
- C₆H₆BrNO₂** Glycine, *N*-(α -bromobutyl)-, 2992².
- C₆H₆Br₂** 3-Hexene, 3,1-dibromo-, 4925¹.
- C₆H₆Br₂ClO** Ether, bis(β -bromo- β' -chloroisopropyl)-, 2152².
- C₆H₆Br₂O** Butyl bromide, α bromo- α -ethyl-, 4163².
Isovaleryl bromide, α -bromo α -methyl-, 4191².
- C₆H₆Br₂O₂** 1,2-Cyclohexanediol, 3,4-dibromo-, 2156².
Isocaproic acid, β , γ -dibromo-, 96².
Propionic acid, α , β -dibromo-, isopropyl ester, 2422². propyl ester, 2422².
- C₆H₆Br₄** Hexane, tetrabromo-, 2695².
- C₆H₆Br₂S** Sulfide, bis(β , γ -dibromopropyl)-, 3565².
- C₆H₆ClNO₂** Glycine, *N*- β -chlorobutyl-, 1389².
- C₆H₆ClNO₃** 2-Butanol, 1-chloro-1-nitro-, acetate, 372².
 $C_6H_6ClNO_3Th_2 + 13H_2O$, 2119².
 $C_6H_6ClNO_3Th_2 + 9H_2O$, 2119².
- C₆H₆Cl₂O** Pyran, 3-chloro-4-(dichloromethyl)-tetrahydro-, 3671².
- C₆H₆Cl₂O₂** β -Dioxane, bis(chloromethyl)-, 2697².
1,4-Dioxolane, 2-(α , β -dichloropropyl)-, 1402².
- C₆H₆Cl₂O₃Pb**, 2647².
- C₆H₆Cl₃NO** Acetamide, α -trichloro-*N*,*N*-diethyl-, 3208².
- C₆H₆Cl₃O** Ether, bis(β , β' -dichloropropyl)-, 2152².
- C₆H₆FeNO₂Si₃**, 3869², 4417².
- C₆H₆HgO₄** Ethylene, Hg(OAc)₂ compd., 3899².
- C₆H₆KNO₂Th₃ + 30H₂O**, 2119².
- C₆H₆K₂Mo₂O₇**, 4419².
- C₆H₆NNaO₂Th₃ + 10.5H₂O**, 2119².
- C₆H₆N₂** Pyrazole, ethylmethyl-, 1637².
- C₆H₆N₂O₂** 2,5-Piperazinedione, 1,4-dimethyl-, 1471², 2170².
Pyrazolinecarboxylic acid, Et ester, 3704².
—, methyl-, Me ester, 3704².
2-Pyrrolidone, 4,4-dimethyl-1-nitroso-, 819².
—, 4-ethyl-1-nitroso-, 819².
- C₆H₆N₂O₃** Aspartic acid, glycol-, 1429¹.
Glycine, α -methyl *N*,*N'*-carbonylbis-, 1618².
- C₆H₆N₃** (See also *Cardazole*.)
 α , β -Cyclopentamethylenetetrazole, P 396¹.
Pyrimidine, 2,4-bis(methylamino)-, and -HCl, 2941¹.
- C₆H₆N₃O** Bicyclo[3.1.1] 2,1,6,8,9-pentazanon

- 5-ene-3,7-dione, 1-amino-4,8-dimethyl-, 2699⁷.
- Guanidine, α -cyano- α,γ -bis(methylcarbamylyl)-, 2699⁸.
- 2(1)-s-Triazone, tetrahydro-4-imino-1-methyl-6-(methylcarbamyylimino)-, 2699⁹.
- C₆H₁₀O (See also *Cyclohexanone*.)
- Bicyclo[2.1.0]-5-oxapentane, 2,3-dimethyl-, 2696².
- Cyclohexane, 1,2-epoxy-, 3444¹.
- Cyclopentanealdehyde, 3444¹.
- Hexenone, 4197^{4,5}.
- C₆H₈O₂ Bicyclo[4.1.0]-3,7-dioxheptane, 4-methyl-, 2696¹.
- α,α' -Bi[ethylene oxide], β,β' -dimethyl-, 2696¹.
- β -Butenic acid, Et ester, 4443¹.
- Δ^2 -2-Butenol, acetate, 2695².
- Crotonic acid, Et ester, 4443¹.
- Cyclobutanecarboxylic acid, Me ester, 4435².
- Cyclopropanecarboxylic acid, Et ester, 4443¹.
- Hexadienediol, 4013².
- 2,4-Hexanedione, 1877¹, 2424¹, 3685².
- Hexenic acid, 96¹.
- Hydrosorbic acid, 96¹, 3207².
- Isocrotonic acid, Et ester, 4443¹.
- C₆H₈O₂S Acetoacetic acid, thiol-, Et ester, 2939¹.
- 1,3-Dithiole-2-carboxylic acid, 4,5-dihydro-, Et ester, 97¹.
- C₆H₈O₂ (See also "ethyl ester" under *Acetoacetic acid*.)
- Acetic acid, anhydride with butyric acid, P 3479¹.
- Acetoacetic acid, α,α -dimethyl-, 4397¹.
- 1,3-Dioxolane-4-carbinol, 2-vinyl-, 5468¹.
- Homolevulinic acid, 4469¹.
- C₆H₈O₂S Formic acid, thionothiobis-, di-Et ester, 2952².
- C₆H₈O₂ (See also *Adipic acid*.)
- 1,1-Ethanediodiol, diacetate, P 606^{1,2}, P 4231¹.
- Malonic acid, ethylmethyl-, and di-Na salt, 4871².
- , isopropyl-, 5162¹.
- , propyl-, 5163¹.
- Oxalic acid, di-Et ester, 4677¹.
- C₆H₈O₂S Hexane-1,4,5,6-tetrol < 1,5 > anhydride, sulfurous acid ester, 3671¹.
- C₆H₈O₂S Propionic acid, dimobis-, 161¹.
- C₆H₈O₂Se Formic acid, selenobis-, di-Et ester, 3439¹.
- C₆H₈O₂Se Propionic acid, α,α' -diselenobis-, and di-K salt, 2154^{1,2}.
- C₆H₈O₂ Anhydrofructose, 3907¹.
- Galactosan < α ,1,6 > β ,1,6 >, 3669¹.
- Glucosane, 108¹.
- Levogluconan, 2943^{1,2}.
- Rhamnoactone, 1884¹.
- (C₆H₈O₂)_n See Cellulose; Glycogen; Inulin; Starch.
- C₆H₈O₂ Tartaric acid, di-Me ester, 4186¹.
- C₆H₈O₂ Lactic acid, β,β' -dithiobis-, 418¹.
- Propionic acid, dihydroxydithiobis-, 161¹.
- C₆H₈O₇ (See also *Glucuronic acid*.)
- Galactonic acid, α -keto-, and salts, 2440¹.
- Gluconic acid, keto-, 1924¹, 2686².
- Tagaturonic acid, 2440¹.
- , acid, 4908¹.
- , acid, 2790¹, 4909¹.
- C₆H₈AsO₂ Arsenic, 130¹.
- C₆H₈BrO₂ + 4H₂O 1,2-Cyclopentanediol, K salt, 2791¹.
- C₆H₈Br (See also *Cyclohexane, bromo*.)
- 3-Hexene, 3-bromo-, 4925¹.
- C₆H₈BrMgO₂ Carbonic acid, isoamyl ester, bromomagnesium salt, 4925¹.
- C₆H₈BrN₂O₂ (See also *Bromural*.)
- Urea, (bromomethylbutyryl)-, 375^{1,2}.
- , (bromovaleryl)-, 375¹.
- C₆H₈BrO Butyryl bromide, α -ethyl-, 4463¹.
- C₆H₈BrO₂ 1,3-Dioxolane, 2-(β -bromopropyl)-, 2937¹.
- Propionic acid, α -bromo-, isopropyl ester, 596¹.
- C₆H₈BrO₂ Glucose 6-bromohydrin, 108¹.
- C₆H₈Br₂ Hexane, 3,3,4-tribromo-, 4925¹.
- C₆H₈Cl Cyclohexane, chloro-, 4937¹.
- Hexene, chloro-, 3207¹, 4197⁴.
- C₆H₈ClO Caproyl chloride, 4440¹.
- 2-Pentanone, 4-chloro-4-methyl-, 602¹.
- C₆H₈ClO₂ Acetic acid, chloro-, *sec*-Bu ester, 1326¹.
- 1-Butanol, 4-chloro-, acetate, 2422¹.
- m*-Dioxane, 2-(β -chloroethyl)-, 4929¹.
- C₆H₈HgN Pentane, 1-(cyanomercuri)-, 1871¹.
- C₆H₈N Bicyclo[3.1.1]-6-azaheptane, 1131¹.
- Capronitrile, 4440¹.
- C₆H₈NO Caproic acid, α -amino-, lactam, 1622¹.
- Crotonamide, α,β -dimethyl-, 4443¹.
- Pentenamide, methyl-, 96¹.
- 4-Piperidone, 1-methyl-, -HCl, 1902¹.
- 2-Pyrrolidone, 4,4-dimethyl-, 819¹.
- , 4-ethyl-, 819¹.
- C₆H₈NO₂ Carbamic acid, Δ^1 -butenyl-, Me ester, 5163¹.
- 2-Pyrrolidone, 5-hydroxy-1,5-dimethyl-, 4469¹.
- C₆H₈NO₂ Aceturic acid, Et ester, 5161¹.
- C₆H₈NO₂ 2-Butanol, 1-nitro-, acetate, 372¹.
- C₆H₈NO₂Th₂ 2119¹.
- C₆H₈NiNi Nickel cyanide, compd with BuNH₂, 2418¹, compd. with Et₂NH₂, 2418¹.
- C₆H₈N₂O Asparagine, glycol-, 1429¹.
- Glycine, glycyglycyl-, 2730¹.
- C₆H₈N₂ Benzene-pentamine, 2428¹.
- s-Triazine, 2-methyl-4,6-bis(methylamino)-, 3443¹.
- C₆H₈NaO₂S Glucothiosane, Na deriv., 4932¹.
- C₆H₈ (See also *Cyclohexane; Hexene*.)
- 2-Butene, 2,3-dimethyl-, 818¹.
- Pentene, methyl-, 1385¹, 2848¹.
- C₆H₈AgClN₂O₂, 1887¹.
- C₆H₈Ag₂CrN₂O₂, 1887¹.
- C₆H₈AuCl₂, 1886¹.
- C₆H₈BrF₂Na₂ 2-Propanol, 1-trifluoro-, complex salt, 4441¹.
- C₆H₈BrClN₂, 2896¹.
- C₆H₈BrN Cyclohexylamine, 3-bromo-, -HBr, 1131¹.
- C₆H₈BrNO See Newonol.
- C₆H₈Br₂ Pentane, 1,3-dibromo-2-methyl-, 4702¹.
- C₆H₈BrO₂ Ether, β,γ -dibromopropyl isopropyl-, 1110¹.
- C₆H₈BrN₂ s-Triazine, 2,4,6-tris(bromomethyl)benzohydro-, 4319¹.
- C₆H₈ClNO Acetamide, α -chloro-N,N-dimethyl-, 3309¹.
- C₆H₈ClO₂P Phosphoric acid, tris(β -chloroethyl)ester, 3418¹.
- C₆H₈ClO₂ Ethyl ether, with CH₃, 2441¹.
- C₆H₈OnH₂O₂ + 4H₂O 1,2-Cyclopentanediol, K salt, 2791¹.

- $C_6H_{11}HgO_2S$ Acetic acid, butylmercurimer-capto-, 3982².
 $C_6H_{11}N_2O_2$ Glyoxime, dimethyl-, di-Me deriv., 2902².
 1 - Piperazineacetic acid, di-HCl, 2183⁴.
 $C_6H_{11}N_2O_2$ Alanine, N-alanyl-, 2693², 2730⁴.
 Butyric acid, α -glycylamin-, 2993¹.
 Glycine, aminobutyl-, 1111¹, 1389⁴, 2993¹, 5199².
 Isobutyric acid, α - (aminoacetamido) -, 2697², 2698¹.
 Malonamide, α - (α - hydroxyethyl) - α - methyl-, 4447¹.
 $C_6H_{11}N_2O_2S$ See Cystine.
 $C_6H_{11}N_2S_2$ Sulfide, bis(dimethylthiocarbamyl), 4102¹.
 $C_6H_{11}N_2S_2$ Disulfide, bis(dimethylthiocarbamyl), 1307⁴, 4102¹.
 Sulfide, bis(dimethylthiocarbamyl), 1307⁴.
 $C_6H_{11}N_2O_2S_2 + 5H_2O$, 2898².
 $C_6H_{11}N_4$ (See also Hexamethylenetetramine.)
 s - Triazole, 3 - amino - 5 - isobutyl -, nitrate, 3471¹.
 $C_6H_{11}N_2O$ Glycocyanidine, 5 - (γ - amino-propyl)-, 1621⁴.
 $C_6H_{11}N_2$ Benzenehexamine, 823²; and tetra-HCl, 2428⁴.
 $C_6H_{11}O$ (See also Cyclohexanol; Pinacolin.)
 Butyraldehyde, α , α - dimethyl -, 2420⁸.
 Ether, allyl isopropyl, 1110¹.
 Ether, allyl propyl, 1110¹.
 Ether, Δ^2 -butenyl ethyl, 2695¹.
 Ether, ethyl α -methylallyl, 2695¹.
 Ethylene oxide, α - isopropyl - α - methyl -, 2694².
 Furan, tetrahydro-2,2-dimethyl-, 4935⁴.
 2-Hexanone, 1472¹.
 Hexenol, 2695¹, 4197⁴.
 Δ^2 -2-Pentenol, 2-methyl-, 4935⁴.
 $C_6H_{11}O_2$ (See also Acetic acid, Bu ester, Caproic acid; Isocaproic acid.)
 Acetic acid, sec-Bu ester, P 5196⁴, isobutyl ester, 10⁴.
 Butyric acid, Et ester, 320⁸.
 —, α , α -dimethyl-, 1108¹, 3438⁴.
 —, ethyl-, 3632².
 Cyclohexanediol, 1119¹, 2005², 2420⁴, 4677¹.
 1,2 - Cyclopentenediol, 1 - methyl -, 2095⁴, 2701¹.
 m-Dioxane, 5,5-dimethyl-, 1615².
 1,3 - Dioxolane, 2 - ethyl - 2 - methyl -, 4671¹.
 —, 2-propyl-, 2937².
 Ethanol, 2-(Δ^2 -butenyloxy)-, 2937².
 Hexanone, hydroxy-, 100⁴, P 3477¹.
 Hexenediol, 2696¹.
 2 - Pentanone, 4 - hydroxy - 4 - methyl -, P 1419⁴, 2638², P 3477¹.
 Valeric acid, α -methyl-, 3632².
 $C_6H_{11}O_2$ (See also Malaldehyde; Paraldehyde.)
 Caproic acid, hydroxy-, 100⁴, 3496¹, Na salt, 818².
 2-m-Dioxanethanol, 4920².
 Hexane-1,4,5,6-tetrol < 1,6 > anhydride, 3671¹.
 Valeric acid, α - hydroxy - α - methyl -, 4673⁴.
 $C_6H_{11}O_2$ Diglucoside, 3969².
 p-Dioxanedecarbinol, 2697¹.
 $C_6H_{11}O_2S_2$ 2,6-Hexamethiol, cyclic ester with H_2SO_4 , 3437¹.
 $C_6H_{11}O_2$ (See also Resonance.)
 Altromethylene, 2940².
 1,3 - Dioxolane, 2 - (α , β - dihydroxyethyl) - 4-(hydroxymethyl)-, 5468².
 Isorhodose, 4449².
 Lyxoside, α methyl-, 1881¹.
 Quinovose, 2939², 4449².
 Xyloside, α -methyl-, 4450¹, 5165².
 $C_6H_{11}O_2S$ Glucothiose, 4932¹.
 $C_6H_{11}O_2$ See Fructose; Galactose; d-Glucose, Inositol, Mannose; Scyllitol.
 $C_6H_{11}O_2$ (See also Gluconic acid.)
 Galactonic acid, 4920⁴, Cd salt, 5382¹.
 $C_6H_{11}O_2 \cdot Th_2$ + 4H₂O, 2119⁴.
 $C_6H_{11}S_2$ s - Trithiane, 2,4,6 - trimethyl -, 4670².
 $C_6H_7S_2$ Formic acid, dithio-, Me ester, trimer, 4139¹.
 $C_6H_7AsO_6$ Triglycolarsenic acid, 595².
 C_6H_7BrHg Hexane, 1-(bromomercuri)-, 1870².
 C_6H_7BrMg Hexylmagnesium bromide, 2934².
 C_6H_7BrO Pentanol, bromomethyl-, 4702¹.
 C_6H_7ClHg Hexane, 1-(chloromercuri)-, 1870².
 C_6H_7ClO 2 - Butanol, 1 - chloro - 2,3 - dimethyl-, 2694².
 $C_6H_7Cl_2N$ Chloroallyltrimethylammonium chloride, 2150².
 $C_6H_7Cl_2N \cdot O \cdot Pt$, 1583².
 $C_6H_7Cl_2Cu \cdot N \cdot O$ + 2H₂O, 2896².
 $C_6H_7Cl_2N \cdot O \cdot Pt$, 1583².
 C_6H_7HgI Hexane, α -(iodomercuri)-, 1870².
 $C_6H_7HgNO_2$ Hexane, 1-(hydroxymmercuri)-, nitrate, 1871¹.
 C_6H_7I See Hexane, indo-.
 C_6H_7KN Isocaproamidine, K salt, 596².
 C_6H_7N Cyclohexylamine, P 1651⁴, P 4712², P 5197¹.
 2 Pipecoline, and -HCl, 4703².
 C_6H_7NO Acetamide, N-isobutyl-, 2419².
 Caproamide, 3410², 4440².
 Morpholine, 2,6-dimethyl-, P 2723².
 Propionaldehyde, β - propylamino -, 3204².
 $C_6H_7NO_2$ (See also Leucine.)
 Caproic acid, ϵ -amino-, 2744².
 Hedonal, 201¹, 1413¹.
 Isoleucine, 1877¹, 5486⁴.
 Norleucine, 1877¹.
 $C_6H_7NO_2$ Alanine, α -glyceride, 4673¹.
 $C_6H_7NO_2$ Glucosamine, 2155², 2863².
 C_6H_7N Piperidine, 1-quanyl-, 1115¹.
 $C_6H_7N \cdot O_2$ Biuret, 1-butyl-, 3442².
 Biuret, 1,1-diethyl-, 3442².
 $C_6H_7N_2$ Biquamide, α - Δ^2 - butenyl -, -H₂SO₄, 4931².
 $C_6H_7N_2O_2$ α - Biguanideacetic acid, β - dimethyl-, -HCl, 4931².
 $C_6H_7O \cdot P$ Hexosephosphoric acid, 1885².
 C_6H_{11} (See also Hexane.)
 Butane, dimethyl-, 1054², 1386¹, 3610².
 Pentane, 2-methyl-, 3610².
 C_6H_7AsCl Arsine, chloroisamylmethyl-, 120².
 $C_6H_7AsCl_2N$ Arsine, dichloro(γ - propylamino propyl)-, -HCl, 92².
 C_6H_7AsI Arsine, iododipropyl-, 121¹.
 $C_6H_7BrN \cdot O_2$ (Carbamylcarbamylmethyl) trimethylammonium bromide, 3023².
 C_6H_7CaN Propionamidine, Ca salt, 596².
 C_6H_7ClN Triethylamine, β -chloro-, chloroanurate, 92².
 C_6H_7ClNO α - Hydroxyallyl(trimethylammonium chloride), 2150².
 C_6H_7HgO Hexane, 1 - (hydroxymmercuri) -, 1870².
 $C_6H_7HgO_2S$ Propane, 1 - (hydroxymmercuri) -, sulfate, 1871¹.
 C_6H_7N Piperazine, 1-ethyl-, and salts, 2183⁴.

- C₂H₁₄N₂O** Butyramide, *N* - methyl - β - methyl-amino-, 3207⁴.
 1-Piperazinethanol, *salts*, 2183⁴.
C₂H₁₄N₂O₂ 2, 3 - Butanediamine, oxalate, 3663¹.
C₂H₁₄N₂S Pseudourea, α, α - diethyl - γ - methyl-thio-, P 2447⁴.
C₂H₁₄N₂S₂ Carbamic acid, (ϵ -aminoamyl)di-thio-, 1880⁹.
C₂H₁₄N₂O₂ (See also *Arginine*.)
 Isoarginine, 1621⁶.
C₂H₁₄N₂S₂ Carbamic acid, (δ -guanidobutyl)-dithio-, 1881⁹.
C₂H₁₄N₂ Piperazine, 1, 4-diguanyl-, 1115⁴.
C₂H₁₄O 1-Butanol, 2, 2-dimethyl-, 2420⁴.
 2-Hexanol, 100¹.
 Hexyl alcohol, 5074⁴.
 Isopropyl ether, 5158^{4, 5}.
 Propyl ether, 5074⁴.
C₂H₁₄OS 1-Butanol, 4-(ethylmercapto)-, 2423¹.
 1 - Pentanol, 5 - methylmercapto -, 2423².
 1 - Propanol, 3 - propylmercapto -, 2422⁹.
 Propyl sulfoxide, 4669².
C₂H₁₄O₂ (See also *Pinacol*.)
 Acetal, P 2191⁴, 2639⁴.
 1, 3 - Pentanediol, 2 - methyl -, 4702⁷.
C₂H₁₄O₂S Isopropyl sulfate, 4669¹.
 Propyl sulfate, 1107⁴, 4669¹.
C₂H₁₄O₂ (See also *Mannitol*; *Sorbitol*.)
 Dulcitol, 4909¹.
C₂H₁₄O₂S₂ 2, 5 - Hexanediol, diacid sulfate, and its *Ba salt*, 3437^{1, 4}.
C₂H₁₄O₂P₂ γ - Fructose - 1, 6 - diphosphoric acid, 1115⁴.
 Hexosephosphoric acid, di-, 821⁷.
C₂H₁₄S Propyl sulfide, *HgCl₂ compd.*, 3565², 4925⁴.
C₂H₁₄Zn Zinc propyl, 1386³.
C₂H₁₄AlO Aluminum ethoxide, P 3718².
C₂H₁₄As Arsine, triethyl-, *HgCl₂ compd.*, 1614⁴.
C₂H₁₄AsO Ethyl arsenite, 2703⁴.
C₂H₁₄AsO₂ Ethyl arsenate, 2703⁴.
C₂H₁₄BF₃N Triethylamino boron fluoride, 5124⁷.
C₂H₁₄Cd₂N₂O₂ 4194³.
C₂H₁₄ClN₂O Trimethyl(methylcarbamy)methyl) ammonium chloride, 3023¹.
C₂H₁₄CrO₂ Chromium ethoxide, 4904⁴.
C₂H₁₄FeO₂ Iron ethoxide, 5157¹.
C₂H₁₄ITe Triethyltelluronium iodide, 2113⁷.
C₂H₁₄N (See also *Dipropylamine*; *Triethylamine*.)
 Hexylamine, *hydrohalides*, 2083⁷.
C₂H₁₄NO Butylamine, γ -ethoxy-, 4669⁴.
C₂H₁₄NO₂ 1 - Propanol, 2 - ethoxy - 3 - methyl-amino-, P 3234¹.
 Propionaldehyde, β - methylamino -, di-methyl acetal, 3209².
C₂H₁₄NO₂ Triethylamine, β, β', β'' -trihydroxy-, P 3223², 3824².
C₂H₁₄N₂O₂P Argininephosphoric acid, 910⁴.
C₂H₁₄N₂ Biguanide, $\alpha, \alpha, \epsilon, \epsilon$ - tetramethyl -, *hydrogen sulfate*, 4931¹.
C₂H₁₄O₂P Ethyl phosphite, 2703⁷.
C₂H₁₄O₂P Ethyl phosphate, 2703⁷.
● Phosphoric acid, di-*Pr ester*, *Ba salt*, 2418⁴.
C₂H₁₄O₂V Ethyl vanadate, 2703⁷.
C₂H₁₄P Phosphine, triethyl-, 2699⁴.
C₂H₁₄AsNO₂ 1 - Propanearsonic acid, 3 - propyl-amino-, and -*HCl*, 92⁷.
C₂H₁₄ClCoN₂O₂, 3868².
C₂H₁₄CoN₂O₂ + *H₂O*, 3868².
C₂H₁₄N₂ 1, 6 - Hexanediamine, di-*HCl*, 4932¹.
C₂H₁₄N₂O₂S Histone, 4746².
C₂H₁₄N₂ Guanidine, (ϵ - aminoamyl) -, and *salts*, 1881⁹; -*H₂SO₄*, P 613².
C₂H₁₄N₂ Guanidine, α, α' - 1, 4 - butylenebis -, and *salts*, 1881¹.
C₂H₁₄N₂S₂ Guanidine, α, α' - trimethylenebis -, trithiocarbonate, 1881².
C₂H₁₄N₂S Biguanide, α, α' - ethylenebis -, -*H₂SO₄*, 4932¹.
C₂H₁₄O₂P₂ Pyrophosphoric acid, di-*Pr ester*, *Ba salt*, 2418⁴.
C₂H₁₄AsClNO₂ (γ - Arsonopropyl)trimethyl-ammonium chloride, 927⁷.
C₂H₁₄Ag₂CoN₂, 4902⁸.
C₂H₁₄As₂ClNO₂ Bis(β - arsonoethyl)dimethyl-ammonium chloride, 92⁸.
C₂H₁₄As₂NO₂ Ethaneearsonic acid, 2, 2', 2''-nitritoltris-, and *salts*, 92⁴.
C₂H₁₄As₂CoN₂, 4902⁸.
C₂H₁₄BrLiN₂ Addn. compd. from LiBr and Me₂N, 2118¹.
C₂H₁₄ClLiN₂ Addn. compd. from LiCl and Me₂N, 2118⁷.
C₂H₁₄Cl₂CrO₂ Chromium chloride compd. with EtOH, 4904³.
C₂H₁₄N₂ Triethylamine, β, β', β'' - triamino -, 2900⁴.
C₂H₁₄ClN₂O₂P₂, 1581⁴.
C₂H₁₄Cl₂MoN₂O₂ + *H₂O*, 2899⁷.
C₂H₁₄BrLiN₂ Addn. compd. from LiBr and Me₂NH, 2118¹.
C₂H₁₄ClLiN₂ Addn. compd. from LiCl and Me₂NH, 2118⁷.
C₂H₁₄LiLiN₂ Addn. compd. from LiI and Me₂NH, 2118¹.
C₂H₁₄I₂N₂Pd, 3868¹.
C₂H₁₄I₂N₂Zn, 3868¹.
C₂H₁₄Cl₂FeN₂, 3638⁴.
C₂H₁₄Cl₂N₂Ni + 2*H₂O*, 2384⁹.
C₂H₁₄Co₂N₂O₁₇, 2899⁷.
C₂H₁₄Co₂N₂O₁₁, 2899⁷.
C₂H₁₄Benzene, hexaoido-, 1614².
C₂H₁₄N₂Pt Potassium cyanoplatinate, 1818⁴.
C₂H₁₄N₂Et₂H, 2673⁹.
C₂H₁₄O₂Sc + 4*H₂O*, 2698⁴, 3180⁴.
C₂H₁₄N₂Ni Potassium nickelocyanide, 1818⁴.
C₂MoO₂ Molybdenum carbonyl, 353¹, 2650⁴.
C₂Mo₂O₁₇, 4419⁴.
C₂N₂Et₂H + 7*H₂O*, 2674¹.
C₂N₂O₂ Benzene, trinitrotriazazo-, 3101⁴.
C₂Na₂O₂Sc + 6*H₂O*, 2698⁴.
C₂Na₂O₁₇Sc + 6*H₂O* Scandium sodium oxalate, 3180⁴.
C₂NeO₂ Neodymium oxalate, 4139².
C₂O₂ Triquinoyl, 3463⁴.
C₂O₂W Tungsten carbonyl, 352⁹.
C₂O₂Sm See *Scandium oxalate*.
C₂O₂S₂ Samarium oxalate, 4139².
C₂EtBr₂Cl₂NO Benzaldehyde, 3, 5 - dibromo - 2, 4 - dichloro - 6 - nitro -, 1891⁴.
C₂EtBr₂N₂O Benzoic acid, 3, 4, 5 - tribromo - 2, 6-dinitro-, 1890⁴.
C₂EtBr₂NO Benzaldehyde, 2, 3, 4, 5 - tetra-bromo - 6 - nitro -, 1891⁴.
C₂EtBr₂N₂O Benzoic acid, 2, 3, 4, 5 - tetrabromo - 6-nitro-, 1891⁴.
C₂EtCl₂N₂O Benzoic acid, 3, 4, 5 - trichloro - 2, 6-dinitro-, 1891⁴.
C₂EtBr₂O Benzaldehyde, 2, 3, 4, 5 - tetrabromo -, 1891⁴.
C₂EtBr₂O Benzoic acid, 2, 3, 4, 5 - tetrabromo -, 1891⁴.
C₂EtCl₂NO Benzaldehyde, 3, 4, 5 - trichloro - 2-nitro-, 1891⁴.

- $C_7H_5Cl_3NO$ Benzoic acid, 3,4,5 - trichloro - 2 - nitro-, 1891¹.
- $C_7H_5BrClNO$ Benzaldehyde, 3 - bromo - 2 - chloro - 4 - hydroxy - 5 - nitro-, 1893³.
Salicylaldehyde, bromochloronitro-, 1893³.
- $C_7H_5BrClNS$ Benzothiazole, 5 - bromo - 1 - chloro-, 2973⁴.
- C_7H_5BrFNO Benzaldehyde, 3 - bromo - 2 - fluoro - 4 - hydroxy - 5 - nitro-, 5177⁴.
Salicylaldehyde, bromofluoronitro-, 5177⁴.
- C_7H_5BrINO Salicylaldehyde, bromoiodonitro-, 1894^{1,2}.
- $C_7H_5BrN_2O$ Benzaldehyde, 2 - bromo - 4 - hydroxy - 3,5 - dinitro-, 1893³.
Benzene, 1 - bromo - 4,5 - methylenedioxy - 2,3-dinitro-, 4204⁴.
Salicylaldehyde, 4 - bromo - 3,5 - dinitro-, 1893³.
- $C_7H_5Br_2ClO$ Benzoyl chloride, dibromo-, 1886³, 1887¹.
- $C_7H_5Br_2N$ Benzonitrile, 2,4 - dibromo-, 3217³.
- $C_7H_5Br_2NO$ Benzaldehyde, 2,3 - dibromo - 4 - hydroxy - 5 - nitro-, 1893³.
Salicylaldehyde, dibromonitro-, 1893³, 1894¹.
- $C_7H_5Br_3$ Toluene, pentabromo-, 4936³.
- $C_7H_5Cl_2NO$ Benzaldehyde, 2 - chloro - 4 - hydroxy - 3,5 - dinitro-, 1893³.
Salicylaldehyde, 4 - chloro - 3,5 - dinitro-, 1893³.
- $C_7H_5Cl_3O$ Benzaldehyde, 3,4,5 - trichloro-, 1891¹.
- $C_7H_5Cl_3O_2$ Benzoic acid, 3,4,5 - trichloro-, 1891¹.
- $C_7H_5Cl_5$ Toluene, $\alpha, \alpha, \alpha, 3,4,5$ - pentachloro-, 1630⁴.
- $C_7H_5F_2NO$ Benzaldehyde, 2 - fluoro - 4 - hydroxy - 3,5 - dinitro-, 5177⁴.
Salicylaldehyde, 4 - fluoro - 3,5 - dinitro-, 5177⁴.
- C_7H_5HgNO Benzoic acid, anhydro - 2 - hydroxymercuri - 3 - nitro-, 1401⁴.
- $C_7H_5I_2NO$ Benzaldehyde, 4 - hydroxy - 2 - iodo - 3,5 - dinitro-, 1894¹.
Salicylaldehyde, 4 - iodo - 3,5 - dinitro-, 1894¹.
- C_7H_5NO Cinchomeronic anhydride, 2976⁴.
- $C_7H_5N_2O$ Benzoic acid, 2,4,6-trinitro-, 5130³.
- $C_7H_5AsCl_2NO$ Benzoic acid, 4 - dichloroarsyl - 3-nitro-, 2959⁴.
- $C_7H_5AsNO_2$ Benzoxazalone - 4 - arsenic disulfide, 1-thio-, 3448⁷.
- C_7H_5BrClO Benzoyl chloride, bromo-, 1886³.
- $C_7H_5BrClO_2$ Benzaldehyde, bromochlorohydroxy-, 1893^{3,4}.
Salicylaldehyde, bromochloro-, 1893^{3,4}.
- C_7H_5BrFO Benzaldehyde, 3 - bromo - 2 - fluoro - 4 - hydroxy-, 5177⁴.
Salicylaldehyde, 3 - bromo - 4 - fluoro-, 5177⁴.
- C_7H_5BrIO Benzaldehyde, 3 - bromo - 4 - hydroxy - 2 - iodo-, 1894¹.
Salicylaldehyde, 5 - bromo - 4 - iodo-, 1894¹.
- C_7H_5BrN Benzonitrile, bromo-, 1044⁴.
- C_7H_5BrNO Benzaldehyde, 2 - bromo - 4 - hydroxy-5-nitro-, 1893³.
Benzoic acid, 2 - bromo - 3 - nitro-, 1401⁴.
Salicylaldehyde, 4 - bromo - 5 - nitro-, 1893³.
- $C_7H_5Br_2ClNO$ Anisole, 3,5 - dibromo - 4 - chloro - 2 - nitro-, 3675¹.
- $C_7H_5Br_2INO$ Anisole, 3,5 - dibromo - 4 - iodo-2-nitro-, 3675¹.
- $C_7H_5Br_2O$ Benzaldehyde, 2,3 - dibromo - 4 - hydroxy-, 1893³.
Benzoic acid, 2,4 - dibromo-, 3217³.
- Salicylaldehyde, dibromo-, 1893³, 1894¹.
- $C_7H_5ClNO_2S$ Anthranoyl chloride, *N*-sulfinyl-, 3913¹.
Benzoyl chloride, *p*-sulfinylamino-, 3913¹.
- C_7H_5ClNO Benzoyl chloride, nitro-, 2935⁴, 5156³.
- $C_7H_5ClNO_2S$ Saccharin, 6-chloro-, 2163³.
- C_7H_5ClNO Benzaldehyde, 2 - chloro - 4 - hydroxy - 5 - nitro-, 1893³.
Salicylaldehyde, 4 - chloro - 5 - nitro-, 1893³.
- $C_7H_5ClNO_2$ Benzoic acid, 2 - chloro - 4 - hydroxy-5-nitro-, 2164⁷.
- C_7H_5ClNS Benzisothiazole, 2-chloro-, 141⁴.
- $C_7H_5Cl_2O$ Benzoyl chloride, *o*-chloro-, 2164⁴.
- $C_7H_5Cl_2O_2S$ 3 - Benzisothioxolone, 1,1 - dichloride, 827⁹.
- $C_7H_5Cl_3NO$ Picolinic acid, trichloro-, Me ester, 838⁹.
- $C_7H_5Cl_3O_2$ 1,3,5 - Benzenetrissulfonyl chloride, 2 - chloro - 4 - methyl-, 1630⁴.
- C_7H_5FNO Benzaldehyde, 2 - fluoro - 4 - hydroxy-5-nitro-, 5177⁴.
Salicylaldehyde, 4 - fluoro - 5 - nitro-, 5177⁴.
- $C_7H_5HgO_2$ Benzoic acid, 2 - (hydroxymercuri)-, anhydride, 4943³.
- $C_7H_5HgO_2S$ Salicylic acid, 3 - (hydroxymercuri) - 5 - sulfo-, cyclic mercuric sulfonate, 4685¹.
- C_7H_5INO Benzaldehyde, 4 - hydroxy - 2 - iodo-5-nitro-, 1894¹.
Benzoic acid, 2 - iodo - 3 - nitro-, 1401⁴.
Salicylaldehyde, 4 - iodo - 5 - nitro-, 1894¹.
- $C_7H_5N_2O$ 2-Benzisoxazolol, 5-nitro-, 2974¹.
1(2) - Benzoxazalone, 5 - nitro-, 2974¹.
- $C_7H_5N_2O_2$ Benzaldehyde, 2,4 - dinitro-, 4682⁹.
- $C_7H_5N_2O$ Anisole, 2,3,5,6 - tetranitro-, 4207¹.
- $C_7H_5O_2S$ Benzoic acid, *o*-sulfo-, anhydride, 2165¹.
- $C_7H_5AsN_2O$ 5-Benzoxazolinearsenic acid, 1-keto-6-nitro-, 842⁴.
- $C_7H_5As_2S$ Benzimidazole - 5 - arsenic disulfide, 2-thiol-, 3449¹.
- $C_7H_5BrClKN_2O$ *p* - Toluidine, 5 - bromo - 2 - chloro - *N* - nitroso-, K deriv., P 2190⁷, P 4710⁷.
- $C_7H_5BrClN_2NaO$ *p* - Toluidine, 5 - bromo - 2 - chloro - *N* - nitroso-, Na deriv., P 2190⁷.
- $C_7H_5BrFNO_2$ Benzaldehyde, 3 - bromo - 2 - fluoro - 4 - hydroxy-, oxime, 5177⁴.
- $C_7H_5Br_2Cl$ Aniline, 4 - bromo - *N* - methyl - 2,6 - dinitro - *N* - nitroso-, 117⁹.
- $C_7H_5Br_2NO$ Aniline, 4 - bromo - *N* - methyl - *N*,2,6 - trinitro-, 118¹.
- C_7H_5BrO Benzaldehyde, bromohydroxy-, 1893³, 4462⁷.
Salicylaldehyde, 4-bromo-, 1893³.
- C_7H_5BrO Benzoic acid, 2 - bromo - 3 - hydroxy-, 5178⁹.
Protocatechualdehyde, 6 - bromo-, 4204⁷.
- $C_7H_5Br_2Cl$ Toluene, dibromochloro-, 1886³.
- $C_7H_5Br_2ClO$ Anisole, dibromochloro-, 3675^{1,2}.
- $C_7H_5Br_2IO$ Anisole, dibromoiodo-, 3675^{1,2}.
- $C_7H_5Br_2NO$ Anisole, 3,5 - dibromo - 2 - nitro-, 3675¹.
- $C_7H_5Br_2O$ Anisole, tribromo-, 3675^{1,2}.
m-Cresol, tribromo-, 3909⁹.
- $C_7H_5ClHgO_2$ Benzoic acid, *o*-(chloromercuri)-, 5172⁹.
- $C_7H_5ClHgO_2S$ Salicylic acid, 3-(chloromercuri)-5-sulfo-, 4685¹.

- C₇H₅ClNNaO₄S** Benzoic acid, *p* - (chlorosulfamyl)-, *N*-Na deriv., *Ca salt*, P 1138¹.
C₇H₅ClO (See also *Benzoyl chloride*.)
 Benzaldehyde, *o*-chloro-, 2164¹.
C₇H₅ClO₂ (See also *Benzoic acid, chloro*.)
 Benzaldehyde, 2 - chloro - 4 - hydroxy -, 1893¹.
 Salicylaldehyde, 4-chloro-, 1893¹.
C₇H₅ClO₃ Salicylic acid, 3-chloro-, 2163¹.
C₇H₅Cl₂KN₂O Toluidine, dichloro - *N* - nitroso -, *K* deriv., P 2190¹, P 4710¹.
C₇H₅Cl₂NO Benzaldehyde, 4 - amino - 3,5 - dichloro-, 1890¹.
C₇H₅Cl₂NO₂ Picolinic acid, 4,6 - dichloro -, *Me ester*, 838¹.
C₇H₅Cl₂NO₂S *m* - Benzenedisulfonyl chloride, 4 - hydroxy - 6 - methyl - 5 - nitro -, 1630¹.
C₇H₅Cl₂N₂NaO Toluidine, dichloro - *N* - nitroso -, *Na deriv.*, P 2190¹.
C₇H₅Cl₃ Toluene, trichloro-, 4620¹.
C₇H₅Cl₃O₂S Benzenedisulfonyl chloride, chloromethyl-, 1630¹.
C₇H₅Cl₃O₂S 1,3,5 - Benzenetrissulfonyl chloride, 2 - hydroxy - 4 - methyl -, 1630¹.
C₇H₅FN₂O Benzaldehyde, 2 - fluoro - 4 - hydroxy - 5 - nitro -, oxime, 5177¹.
C₇H₅FO Benzaldehyde, 2 - fluoro - 4 - hydroxy -, 5176¹.
 Salicylaldehyde, 4-fluoro-, 5176¹.
C₇H₅FO Salicylic acid, 4-fluoro-, 5177¹.
C₇H₅IO Benzaldehyde, 4 - hydroxy - 2 - iodo -, 1894¹.
 Benzoic acid, iodo-, 4775¹.
 Salicylaldehyde, 4-iodo-, 1894¹.
C₇H₅KN₂O Hydrazomethylene, 1 - phenylazo - 1,3-endoxy-, *K* deriv., 4939¹.
C₇H₅N See *Benzonitrile*.
C₇H₅NO Isocyanic acid, *Ph ester*, 3681¹, 3903¹, 3909¹.
C₇H₅NO₂ 2(1)-Benzisothiazolone, 141¹.
C₇H₅NO₂ (See also *Benzaldehyde, nitro*.)
 Benzoic acid, *o*-nitroso-, 4203¹.
C₇H₅NO₂ (See also *Benzoic acid, nitro*.)
 Benzaldehyde, hydroxynitro-, 4462¹.
 Cinchomeronic acid, 5320¹.
 Salicylic acid, nitroso-, 1632¹.
C₇H₅NO₃ Protopatechualdehyde, 6-nitro-, 4204¹.
C₇H₅NS Isothiocyanic acid, *Ph ester*, 3445¹, 3903¹, 3909¹.
C₇H₅NS Benzothiazole, 1-mercapto-, P 3236¹, P 4952¹.
C₇H₅N₂O Benzoyl azide, 4470¹.
C₇H₅N₂O Benzoxazole, 2 - amino - 5 - nitro -, 2974¹.
C₇H₅N₂O See *Toluene, trinitro*.
C₇H₅N₂O (See also *Cresol, trinitro*.)
 Anisole, trinitro-, 3214¹, 4207¹.
C₇H₅N₂O Tetryl, 2349¹, 2824¹.
C₇H₅NaO See *Sodium salicylate*.
C₇H₅AsBrCl₂ Arsine, (bromotolyl) dichloro -, 3446¹, 3447¹.
C₇H₅AsBrO Toluene, arsinobromo-, 3446¹, 3447¹.
C₇H₅AsBrO₂ Benzoic acid, 4 - arsono - 3 - bromo-, 3446¹.
C₇H₅AsBr₂NO Arsine, dibromo(6 - nitro - *o* - tolyl)-, 3447¹.
C₇H₅AsClO Toluene, arsinochloro-, 3446¹, 3447¹.
C₇H₅AsClO₂ Benzoic acid, 4 - arsono - 3 - chloro-, 3446¹.
C₇H₅AsCl₂NO Arsine, dichloro(nitrotolyl) -, 3447¹.
C₇H₅AsCl₂ Arsine, dichloro(chlorotolyl) -, 3446¹, 3447¹.
C₇H₅AsNO₂S 4 - Benzoxazolinearsonic acid, 1 - thioketo-, 3448¹.
C₇H₅AsNO₂ Benzoxazolinearsonic acid, 1-keto-, 842¹, P 1474¹.
C₇H₅AsNO₂ Benzoic acid, 4 - dihydroxyarsyl - 3-nitro-, 2959¹.
C₇H₅AsNO₂ Benzenearsonic acid, 4,5 - methylenedioxy-2-nitro-, 3677¹.
C₇H₅AsNO₂ Salicylic acid, 5 - arsono - 3 - nitro-, 841¹.
C₇H₅BrCl Toluene, bromochloro-, 1886¹.
C₇H₅BrClO Anisole, 2 - bromo - 4 - chloro -, 1128¹.
C₇H₅BrN₂O *o* - Toluidine, 5 - bromo - *N* - nitroso-, *K* deriv., P 2190¹, P 4710¹.
C₇H₅BrNO Benzoic acid, 4-aminobromo-, 1892¹.
 Toluene, bromonitro-, 4473¹.
C₇H₅BrNO Anisole, 2 - bromo - 4 - nitro -, 824¹.
C₇H₅BrN₂NaO *o* - Toluidine, 5 - bromo - *N* - nitroso-, *Na deriv.*, P 2190¹.
C₇H₅BrN₂O Aniline, 4 - bromo - *N* - methyl - 2,6-dinitro-, 117¹.
C₇H₅Br₂N₂O *p* - Anisidine, 2,6 - dibromo - 3-nitro-, 3675¹.
C₇H₅Br₂O Anisole, dibromo-, 3675¹.
C₇H₅Br₂O Guaiacol, 5,6-dibromo-, 3675¹.
C₇H₅Cl₂KN₂O *m* - Anisidine, 6 - chloro - *N* - nitroso-, *K* deriv., P 2190¹.
 Toluene, chloro - *N* - nitroso -, *K* deriv., P 2190¹, P 4710¹.
C₇H₅ClNO Anthranoyl chloride, 3912¹.
C₇H₅ClNO Anisole, 3 - chloro - 4 - nitroso -, 4682¹.
 Anthranilic acid, 4-chloro-, 828¹.
 Isonicotinic acid, 3 - chloro -, *Me ester*, 838¹.
 Nicotinic acid, 5 - chloro -, *Me ester*, 838¹.
 Quinone, 2 - chloro -, 1 - oxime, *Me ether*, 4682¹.
C₇H₅ClNO₂S Benzisosulfonazole, 6 - chloro - 1,2-dihydro-, 2164¹.
C₇H₅ClNO₂S *p* - Toluenesulfonic acid, 5 - chloro - 2-nitro-, 3665¹.
C₇H₅ClNO₂S Benzoic acid, aminochlorosulfo -, 286¹.
C₇H₅ClN₂NaO *o* - Anisidine, 5 - chloro - *N* - nitroso-, *Na deriv.*, P 2190¹.
 Toluene, chloro - *N* - nitroso -, *Na deriv.*, P 2190¹.
C₇H₅ClN₂O *p* - Toluidine, 2 - chloro - 3,5 - dinitro-, 827¹.
C₇H₅Cl₂O₂S *o* - Toluenesulfonyl chloride, 6 - chloro - α - hydroxy -, 2164¹.
C₇H₅Cl₂O₂S Benzenedisulfonyl chloride, hydroxymethyl-, 1630¹.
C₇H₅Cl₂NO₂S *p* - Toluenesulfonic acid, 2 - amino - 3,5,6 - trichloro -, P 849¹.
C₇H₅ClNO Benzene, compd. with CCl₄, 2641¹.
C₇H₅FO Benzaldehyde, 2 - fluoro - 4 - hydroxy-, oxime, 5176¹.
 Salicylaldehyde, 4 - fluoro -, oxime, 5176¹.
C₇H₅FN₂O 2117¹.
C₇H₅HgO₂S Salicylic acid, 3 - (hydroxymercuri) 5-sulfo-, 4685¹.
C₇H₅INO Picolinic acid, 4-iodo-, *Me ester*, 838¹.
C₇H₅KN₂STh 2119¹.
C₇H₅NNaO Formanilide, *Na deriv.*, 1124¹.
C₇H₅N Benzimidazole, 141¹.
C₇H₅N₂O Benzoxazole, amino-, 827¹.

- Carbanilnitrile, hydroxy-, P 1649³.
 $C_7H_5N_2O_2S$ Benzisulfonazole, 2-amino-, 4680⁷.
 $C_7H_5N_2O_2$ Benzaldehyde, nitro-, oxime, 3681⁷.
 $C_7H_5N_2O_4$ (See also *Toluene, dinitro-*.)
 Aniline, 4,5 - methylenedioxy - 2 - nitro -, 4204².
 Anthranilic acid, 4-nitro-, P 156⁵.
 Benzoic acid, aminonitro-, P 3108³.
 $C_7H_5N_2O_4$ Anisole, 3,5-dinitro-, 4207².
 Benzohydroxamic acid, 2 - hydroxy - 4 - nitro-, 2974¹.
 $C_7H_5N_2O$ Hydrazomethylene, 1 - phenylazo -, 1,3-endoxy-, and -HCl, 4939^{2,5}.
 2-Imidazolyl ketone, 1639¹.
 $C_7H_5N_2O_2$ 1,2,3,4 - Tetrazole 5 - [(*p* - nitro-phenyl)triazeno]-, 4471¹.
 $C_7H_5O_2$ See *Benzaldehyde*.
 $C_7H_5O_2$ (See also *Benzoic acid*; *Salicylaldehyde*.)
 Benzaldehyde, hydroxy-, 2371¹, P 3717⁴, 4462².
 4-*o*-Toluquinone, 123¹.
 $C_7H_5O_2S$ Benzoic acid, *o*-mercapto-, 5387⁵.
 $C_7H_5O_2$ (See also *Benzoic acid, hydroxy-*; *Perbenzoic acid*; *Salicylic acid*.)
 Furanacrylic acid, 2165⁴, 2968².
 Protocatechualdehyde, 2676¹, 3217⁴, 4462².
 Sesamol, 2055¹.
 $C_7H_5O_2$ Gentisic acid, 3913³.
 Protocatechuic acid, 1930³, 2429⁵.
 γ -Resorcylic acid, 3454⁴.
 $C_7H_5O_2S$ Benzoic acid, *o*-sulfinio-, 827³, 1901⁵.
 $C_7H_5O_2$ (See also *Gallic acid*.)
 3 - Furanacetic acid, 2,5 - dihydro - 2,5 - diketo-, Me ester, 1878⁹.
 1,2 - Pyran - 4 - carboxylic acid, 6 - hydroxy - 2-keto-, Me ester, 1879².
 $C_7H_5O_2S$ Benzoic acid, *o*-sulfo-, *mono-NH*₂ salt, 2164¹.
 $C_7H_5O_2S$ Salicylic acid, 5-sulfo-, Hg salts, 4684⁹, 4868².
 $C_7H_5O_2$ Benzoic acid, dithio-, 4939⁴.
 $C_7H_5AgN_2$ Benzamidide, Ag salt, 596⁵.
 $C_7H_5AsN_2O_2$ Benzimidazolearsonic acid, 3449¹, and salts, 2429².
 $C_7H_5AsN_2O_2S$ 5 - Benzimidazolearsonic acid, 2-mercapto-, 3449¹.
 $C_7H_5AsN_2O_4$ 4 - Benzoxazolearsonic acid, 1 - amino-, 2429².
 $C_7H_5AsN_2O_5$ 5 - Benzoxazolearsonic acid, 6 - amino - 1 - keto -, 842¹.
 $C_7H_5AsO_2$ Benzenearsonic acid, 3,4 - methylenedioxy-, 3677².
 $C_7H_5BiO_4 + H_2O$ See *Dermatol*.
 C_7H_5Br See *Toluene, bromo-*.
 C_7H_5BrMg Tolylmagnesium bromide, 1896⁴, 2934², 5182².
 $C_7H_5BrN_2O$ Aniline, *p* - bromo - *N* - methyl - *N* - nitroso-, 1400⁷.
 Pyridine, 2 - acetamido - 5 - bromo -, 143⁴.
 $C_7H_5BrN_2O_2$ *p* - Toluidine, bromo - *N* - nitro -, 3675⁴.
 $C_7H_5BrO_2$ Benzyl alcohol, 2 - bromo - 5 - hydroxy-, 4462².
 C_7H_5BrNO Anisidine, dibromo-, and salts, 3675^{1,3}.
 C_7H_5Cl See *Toluene, chloro-*.
 C_7H_5ClHg Toluene, (chloromercuri)-, 5172⁴.
 C_7H_5ClHgO Anisole, *o* - (chloromercuri) -, 5172⁴.
 C_7H_5ClMg Benzylmagnesium chloride, 2178², 2934², 2953², 4442².
 $C_7H_5ClNNaO_2S$ See *Chloramine-T*; *Chloramine-70*.
 $C_7H_5ClO_2$ Saligenin, 3-chloro-, 2163⁴.
 $C_7H_5ClO_2S$ See *Toluenesulfonyl chloride*.
 $C_7H_5Cl_2N$ Toluidine, dichloro-, P 396¹, 2044¹, P 2448², P 3236^{4,5}, P 4712².
 $C_7H_5Cl_2NO_2S$ Methanesulfonanilide, 2,5-dichloro-, 2427⁴.
 $C_7H_5CuN_2$ Benzamidine, Cu salt, 596⁵.
 $C_7H_5KN_2$ Benzamidine, K salt, 596⁵.
 C_7H_5NO (See also *Benzamide*.)
 Anthranilaldehyde, 1900¹, 4218².
 Benzaldehyde, oxime, 599⁷, 1120^{3,4}.
 Compd., m. 132.5-3.5°, from $BzCH_2CO_2H$, $PhCH_2NOH$, and $ZnCl_2$, 1121³.
 Formanilide, 4199¹.
p-*p*-Toluquinonimine, 1401³.
 $C_7H_5NO_2$ (See also *Anthranilic acid*; *Benzoic acid, amino-*; *Toluene, nitro-*.)
 Anisole, *p*-nitroso-, 1636³.
 Nicotinic acid, Me ester, 3022².
 Salicylamide, 1179⁴.
 $C_7H_5NO_2S$ Benzisulfonazole, 1,2 - dihydro -, 4680⁴.
 $C_7H_5NO_2$ Anisole, nitro-, 599², 2334¹, 4856².
 Anthranilic acid, 5-hydroxy-, 3913³.
 Benzoic acid, 3 - amino - 4 - hydroxy -, 1399².
p-Cresol, nitro-, 2430⁷.
 Salicylic acid, amino-, 1399², 1632¹, 3913³.
 $C_7H_5NO_2S$ Benzenesulfonamide, *p* - formyl -, 4680².
 2 - Benzisulfonazobol, 1,2 - dihydro -, 4680⁴.
 $C_7H_5NO_2$ Benzyl alcohol, hydroxynitro-, 4462², 4463¹.
 $C_7H_5N_2Na$ Benzamidine, Na salt, 596⁵.
 $C_7H_5N_2NaS$ Urea, phenylthio-, Na deriv., P 1418².
 $C_7H_5N_2O_2$ Aniline, *N* - methyl - *m* - nitro - *N*-nitroso-, 2952².
 $C_7H_5N_2O_4$ *m*-Toluidine, 4,6-dinitro-, 1887⁴.
 $C_7H_5N_2O_4$ *m*-Cresol, 4 - amino - 2,6 - dinitro -, and -HCl, 1888¹.
 Hydroxylamine, β - (3,5 - dinitro - *p* - tolyl)-, 1120¹.
 $C_7H_5N_2$ 1,2,3,4 - Tetrazole, 5 - amino - 1 - phenyl-, P 1909².
 $C_7H_5N_2$ 1,2,3,4 - Tetrazole, 5 - (phenyltriazeno)-, 4471¹.
 C_7H_5 (See also *Toluene*.)
 1,6-Heptadiene, 4366⁴.
 $C_7H_5AsBrO_2$ Tolueneearsonic acid, bromo-, 3446⁷, 3447⁴.
 $C_7H_5AsClO_2$ Tolueneearsonic acid, chloro-, 3446⁴, 3447⁴.
 $C_7H_5AsNO_2$ (See also *Treparsol*.)
 Arsanilic acid, *N* - formyl - 2 - hydroxy -, P 609⁷.
 —, methylenedioxy-, 3677⁴.
o - Tolueneearsonic acid, 6 - nitro -, and *NaH* salt, 3447^{1,3}.
 $C_7H_5AsNO_2$ Salicylic acid, 3 - amino - 5 - arsono-, 841³.
 $C_7H_5AsN_2O_2$ 5 - Benzimidazolearsonic acid, 2 - amino-, 2429².
 C_7H_5BrN *p*-Toluidine, 2-bromo-, 3445⁷.
 $C_7H_5BrNO_2$ (Carboxymethyl)pyridinium bromide, 3022⁷.
 $C_7H_5BrNO_2S$ Methanesulfonanilide, *p*-bromo-, 2427⁴.
 $C_7H_5BrO_2$ Mesoxalic acid, bis(β -bromoethyl) ester, 597².
 C_7H_5ClN Toluidine, chloro-, P 2985².
 $C_7H_5ClNO_2S$ Methanesulfonanilide, chloro-, 2427⁴.

- C₇H₅ClNO₂S** Sulfanilic acid, 2 - chloro - 3 - methyl-, P 849⁷.
m - Toluenesulfonic acid, 2 - amino - 4 - chloro-, P 849⁷.
- C₇H₅ClNO₂S** *m* - Benzenedisulfonic acid, 4 - amino - 6 - chloro - 5 - methyl-, P 849⁷.
- C₇H₅ClNS** Toly mercaptan, aminochloro-, P 5328¹.
- C₇H₅ClN₂O** Anthranilic acid, 4-chloro-, hydrazide, 828².
- C₇H₅ClN₂O₂S** Toluenesulfonic acid, chloro-nitro-, hydrazide, 3665^{1,2}.
- C₇H₅Cl₂N₂** Hydrazine, α - (2,5 - dichlorophenyl) - α - methyl-, 4700³.
- C₇H₅Cl₂O₂** Mesoxalic acid, bis(β -chloroethyl) ester, 597³.
- C₇H₅Cl₂INO₂** Trigonelline, tetrachloroiodidq, 4470³.
- C₇H₅FeN₂O₂** Ethylenediamine, compd. with Fe(CO)₅, 837³.
- C₇H₅MeNO₂**, 2898⁴.
- C₇H₅NNa** Aniline, *N*-methyl-, Na deriv., P 1418⁴.
- C₇H₅N₂O** (See also *Urea*, *phenyl*-.)
 Pyridine, 2-acetamido-, *nitrate*, 143⁴.
- C₇H₅N₂OS** *Urea*, (*p*-hydroxyphenyl)thio-, P 1649³.
- C₇H₅N₂O₂** Quinone, dioxime, Me ether, 4682⁵.
- C₇H₅N₂O₂** Hydroxylamine, β - (3 - nitrotolyl) -, 1120¹.
- C₇H₅N₂O₂** Hydroxylamine, β - 3 - nitro - *p* - anisyl-, 1120¹.
 Spiro[barbituric acid - 5, α' - ethylene oxide], 1,3-dimethyl-, 2442⁶.
- C₇H₅N₂O₂** 4 - Pyrimidinecarboxylic acid, 5 - ethoxy - 1,2,3,6 - tetrahydro - 2,6 - diketo-, 1905⁵.
- C₇H₅N₂S** *Urea*, phenylthio-, 3445⁷.
- C₇H₅N₄** 1,2,4 - Benzotriazine, 1,2,3,4 - tetrahydro - 3 - amino-, and -HCl, 380¹.
- C₇H₅N₄OS** 1,2,3,4,3 - Dithiodiazole, 5 - β - phenylhydrazino-, 2-oxide, 1398².
- C₇H₅N₄O₂** See *Thabromine*; *Theophylline*.
- C₇H₅N₄O₂S** Semicarbazide, 1 - (*o* - nitrophenyl)thio-, 380².
- C₇H₅N₄O₂** Semicarbazide, 1 - (*o* - nitrophenyl) -, 380².
- C₇H₅N₄O₄** Hydrazine, (4,6 - dinitro - *m* - tolyl) -, 1887⁴.
- C₇H₅O** See *Anisole*; *Benzyl alcohol*; *Cresol*.
- C₇H₅OS** Benzyl alcohol, *o*-mercapto-, 2163³.
- C₇H₅OS** Cresol, dimercapto-, 825^{2,3}.
- C₇H₅OS** *m*-Cresol, 2,4,6-trimercapto-, 825³.
- C₇H₅O₂** (See also *Guaiacol*; *Orcinol*; *Saligenin*.)
 Benzyl alcohol, *p*-hydroxy-, 2371³.
 Cyclohexadienecarboxylic acid, 3632⁴.
 1,4 - Pyrone, 2,6 - dimethyl-, 4684².
- C₇H₅O₂** Furanpropionic acid, 2165⁴, 5472³.
 Pyrotritic acid, 3926³.
- C₇H₅O₂S** Benzenesulfonic acid, Me ester, 2159³.
 Toluenesulfonic acid, 5608⁷; *Cr salt*, 4904⁴.
- C₇H₅O₂** Glutinic acid, di-Me ester, 2153³.
 Gluconic acid, β -methyl-, 4480⁴.
- C₇H₅O₂S** Toluenesulfonic acid, hydroxy-, 1738³, P 3307⁴, 5118⁷; and *salts*, 3909^{2,3}.
- C₇H₅O₂** Aconitic acid, mono-Me esters, 1878³.
- C₇H₅OS** Benzyl mercaptan, 36⁴, P 5475¹.
 Toly mercaptan, 36⁴.
- C₇H₅AsN₂O₂** Arsanilic acid, *N*-carbamy-, 2420⁴.
 Benzenearsonic acid, *p*-carbamido-, P 1474³.
- C₇H₅AsN₂O₂** *m* - Arsanilic acid, *N* - carbamyl - 6-hydroxy-, 2420⁴.
- C₇H₅BrN₂** Hydrazine, α - (*p* - bromophenyl) - α -methyl-, 1400⁵.
- C₇H₅Br₂CdN**, 1363¹.
- C₇H₅Br₂N** Pyrrole, 2,4 - dibromo - 3 - ethyl - 5-methyl-, 2184⁴.
- C₇H₅CdCl₂N**, 362².
- C₇H₅ClN₂O₂** Dialuric acid, 5-(chloromethyl)-1,3-dimethyl-, 2442⁴.
- C₇H₅N** See *Aniline*, *N*-methyl-; *Benzylamine*; *Toluidine*.
- C₇H₅NO** (See also *Anisidine*.)
 Benzyl alcohol, *o*-amino-, 2163¹.
 Cresol, amino-, 1399³, 1887⁴, 3445⁷.
 Ketone, ethyl pyrrol, 3979¹.
 2(1) - Pyridone, 1 - ethyl-, -HBr, 3022³.
- C₇H₅NO₂** Caronimide, 2427².
 1,2-Cyclopentane-dicarboximide, 2427².
 1 - Pyrrolecarboxylic acid, 3 - methyl -, Me ester, 4480⁷.
 Saligenin, 5-amino-, 121⁴.
- C₇H₅NO₂S** Methanesulfonanilide, 2427⁴.
 Toluenesulfonamide, 536³.
- C₇H₅N₂O₂Sb** See *Urea*, stibamine.
- C₇H₅N₃** Guanidine, phenyl-, 901⁴, 2495¹, and *salts*, 1399⁴.
- C₇H₅N₃O₂S** 1,3,4 - Thiodiazolid - 2 - one, 4 - acetyl - 5 - (allylimino) -, 2974⁷.
- C₇H₅AsNO₂** *o*-Arsanilic acid, methyl-, 3446⁵, 3447³.
- C₇H₅Br₂O₂** Malonic acid, bis(β -bromoethyl) ester, 597³.
- C₇H₅Cl₂O₂** Malonic acid, bis(β -chloroethyl) ester, 597³.
- C₇H₅F₂FeNO₂**, 2117¹.
- C₇H₅IN** 1-Ethylpyridinium iodide, 1902¹.
- C₇H₅KNO₂STh₃** + 7H₂O, 2119³.
- C₇H₅N₂** 2-*p*-Tolylenediamine, P 4949⁶.
- C₇H₅N₂O** 4(3) - Pyrimidone, 2,3,6 - trimethyl -, -HI, 2978¹.
- C₇H₅N₂OS** 2 - Thiazolidone, 3 - (allylthiocarbamyl)-, 2177⁷.
- C₇H₅N₂O₂** 2(1) - Pyrimidone, 4 - ethoxy - 1 - methyl-, 3930³.
- C₇H₅N₂O** Ketone, methyl 2-pyrrol, semi carbazone, 5183⁷.
- C₇H₅N₂S** Carbohydrazide, α -phenylthio-, 1397³, and -HCl, 140³.
- C₇H₅O** Δ^2 -2-Heptadienone, P 3477².
- C₇H₅OS** Furan, 2 - (ethylmercaptomethyl) -, 5472³.
- C₇H₅O₂** Cyclohexanone, 2 - (hydroxymethyl)ene-, 1398⁷.
- C₇H₅O₂S** 2 - Furanmethylmercaptan, (methoxy methyl)-(?), P 155¹.
- C₇H₅O₂** Acetoacetic acid, α - (methoxymethyl)ene-, Me ester, 829⁷.
 1,1 - Cyclopentenedicarboxylic acid, and *di-Na salt*, 4871³.
 Valeric acid, α,γ -diketo-, Et ester, 4218⁷.
- C₇H₅O₂** Mesoxalic acid, di-Et ester, 2442¹.
 2 - Propanone, dihydroxy -, diacetate, 3902⁴.
- C₇H₅O₂** 1,2,4-Butanetricarboxylic acid, 3668⁵.
 Compd., *m*. 78-80°, from pyruvaldehyde, 3902⁴.
- C₇H₅OS** Compd., *b*. 160-1°, from heptane and sulfur, 2969¹.
- C₇H₅BrMgO₂** Carbonic acid, cyclohexyl ester, bromomagnesium salt, 4925⁵.
- C₇H₅BrN₂O₂** Glycine, *N* - [N - (α - bromopropionyl)glycyl]-, 4192³.
- C₇H₅BrO₂** Isobutyric acid, α -bromo-, allyl ester, 596⁴.
- C₇H₅Br₂CoNO**, 1362³.

- C₇H₁₁BrNOZn**, 1363¹.
C₇H₁₁ClO Pentenoyl chloride, dimethyl-, 967¹.
C₇H₁₁ClO₄ Malonic acid, chloro-, di-Et ester, 2970⁹.
C₇H₁₁Cl₂CoNO, 1362⁹.
C₇H₁₁Cl₂NNiO + 2H₂O, 1363¹.
C₇H₁₁Cl₂NOZn₄, 1363¹.
C₇H₁₁Cl₃O₂ Acetic acid, trichloro-, Am ester, 3207⁵, 4439¹.
C₇H₁₁I₂NOZn, 1363¹.
C₇H₁₁NO Cyclopentanecarboxylic acid, 2 - (aminomethyl)-, cyclic lactam, 2427².
 2-Furanpropylamide, 387⁷.
 2(3) - Pyrrolone, 5 - ethyl - 1 - methyl -, 4460⁴.
C₇H₁₁NO₂ See *Arecoline*.
C₇H₁₁N₃O₂ Histidine, methyl ester, 4508².
 Histidine, 1-methyl-, and -HNO₃, 4481⁴.
C₇H₁₁N₃S Pyrimidine, 2 - (ethylmercapto) - 4 - methylamino-, and -HCl, 2941⁹.
C₇H₁₁N₃S₂ Thiazolidine, 3 - (allylthiocarbamyl)-2-imino-, 2177⁷.
 Δ² - Thiazoline, 2 - (β - allylthiocarbamido) -, 2177⁷.
C₇H₁₁N₃S Urea, α - allyl - β - (5 - methyl - 3 - s-triazolyl)thio-, 1639⁹.
C₇H₁₁NaO₄ Malonic acid, di-Et ester, Na deriv., 2971².
C₇H₁₂ Cyclohexene, methyl-, 2848¹, 4937¹.
 Cyclopropane, (α - methylenepropyl) - (?), 4935⁴.
 - , (α - methylpropenyl) - (?), 4935⁴.
 1-Heptene, 3898².
 Norcarane, 2707².
 1-Pentene, 3-ethyl-, 2149⁹.
C₇H₁₂BrNO₂ Glycine, N - (α - bromoisovaleryl) -, 1618⁹.
C₇H₁₂Br₂O Enanthyl bromide, α-bromo-, 4463⁴.
 Isovalery bromide, α-bromo-α-ethyl-, 4194².
C₇H₁₂ClNO₂ Valine, N-chloroacetyl -, 1389⁹.
C₇H₁₂Cl₂N₂Pt + H₂O, 1582¹.
C₇H₁₂N₂ Imidazole, 1-butyl-, 1638⁴.
 Imidazole, 1,2-diethyl-, 1638⁴.
 Pyrazole, 4 - ethyl - 3,5 - dimethyl -, 4700⁹.
C₇H₁₂N₂O Butanol, imidazolyl-, 1937⁴.
C₇H₁₂N₂O₂ Pyrazolinecarboxylic acid, dimethyl, Me ester, 3704^{2,3}.
 2 - Pyrrolidone, 4 - ethyl - 4 - methyl - 1 - nitroso-, 819¹.
C₇H₁₂N₂O₂S Acetic acid, (4,5 - dihydro - 2 - imidazolylmercapto)-, Et ester, 5164⁴.
C₇H₁₂N₂O₃ Glycine, propyl-, 3484¹.
C₇H₁₂N₂O₄ Alanine, N - (N - carbomethoxyglycyl)-, 1618⁴.
 Glycine, N - (N - carbomethoxyalanyl)-, 1618⁴.
C₇H₁₂O Cycloheptanone, 2702⁷.
 Cyclohexanone, methyl-, P 2991¹.
 Cyclopentanone, 2,5 - dimethyl -, 2702⁹.
 - , 2-ethyl-, 109⁷.
 1 - Hexin - 3 - ol, 3 - methyl -, 4673³.
C₇H₁₂O₂ Cyclohexanecarboxylic acid, P 2986⁷.
Hi salt, 2534¹.
 Cyclohexanol, formate, P 1138¹.
 Heptanedione, 1877⁵, 3685⁴.
 2,4-Hexanedione, 5 - methyl -, 3685⁴.
 2,4-Pentanedione, 3-ethyl-, 1877⁵.
 Pentenic acid, Et ester, 3207².
 - , dimethyl-, 96⁷.
 Δ²-2-Pentanol, acetate, 4196⁴.
 Senecioic acid, Et ester, 3207², 4443⁴.
C₇H₁₃O₂S Ethanol, 2 - (allylmercapto) -, acetate, 2417⁴.
- C₇H₁₂O₂** Cyclohexanecarboxylic acid, 2 - hydroxy-, P 2986⁷.
 1,3 - Dioxolane, 4 - (methoxymethyl) - 2-vinyl-, 5468⁴.
 Enanthic acid, γ-keto-, 4469⁴.
C₇H₁₂O₃ Adipic acid, β-methyl-, 2153⁴.
 Malonic acid, di-Et ester, 4941⁴.
 - , diethyl-, 5162¹; and *dis-Na salt*, 4871³.
 Pimelic acid, 3138⁹.
C₇H₁₂O₄ Glucosennide, methyl-, 105³.
 γ - Xylonolactone, 2,3 - dimethyl -, 5168².
C₇H₁₂O₅ Mesoxalic acid, di-Et ester, 2442⁴.
 Quinic acid, 1992², 2758⁹.
C₇H₁₂BO₃ + 4H₂O 1,2 - Cyclohexanediol, 1 - methyl-, borate, *K salt*, 2701⁴.
C₇H₁₂BrNO (See also *Adaline*.)
 Urea, (α - bromo - α - methylisovaleryl) -, 4194⁷.
C₇H₁₂BrO₂ Isobutyric acid, α - bromo -, isopropyl and Pr esters, 596⁴.
 Isovaleric acid, β-bromo-, Et ester, 1901².
 Propionic acid, α-bromo-, Bu ester, 596⁴.
C₇H₁₂ClO Cycloheptanol, 2-chloro-, 115¹.
C₇H₁₂ClO₂ 1 - Pentanol, 5 - chloro -, acetate, 2423².
C₇H₁₂Cl₂N₂O₂Pt + 2H₂O, 1582², 1583³.
C₇H₁₂Cl₂N₂O₂Pt, 1582², 1583^{2,3}.
C₇H₁₂Cl₂N₂Pt, 1582¹, 1583².
C₇H₁₂HgN Hexane, 1-(cyanomercuri)-, 1871¹.
C₇H₁₂N Bicyclo[3.1.1] - 6 - azaheptane, 6 - methyl-, -HI, 1131⁴.
 Δ¹ - Cyclohexenylamine, N - methyl -, -HI, 1131⁴.
C₇H₁₂NO Enanthic acid, 5-amino-, lactam, 1617².
 Piperidone, dimethyl -, 2427².
 - , ethyl-, -HCl, 1902⁷.
 2 - Pyrrolidone, 4 - ethyl - 4 - methyl -, 819¹.
C₇H₁₂NO₂ Apocarnitine, 3209⁴.
 Crotonic acid, dimethylamino-, methyl ester, betaine, 2451^{4,5}, 3209⁹.
C₇H₁₂NO₃ Alanine, N-acetyl-, Et ester, 5161⁴.
 β-Alanine, N-acetyl-, Et ester, 840⁷.
C₇H₁₂NO₄ 2-Pentanol, 1-nitro-, acetate, 372⁴.
C₇H₁₂NO₅ Rhannohexononitrile, 2942¹.
C₇H₁₂N₂O₄ Mannohexononitrile, 2942¹.
C₇H₁₂N₂O₄ Glycine, N - (N - alanylglucyl) -, 2730⁴, 4192².
 Glycine, N - [N - (N - methylglucyl)glycyl]-, 1389⁶.
C₇H₁₄ Cycloheptane, 2872⁷.
 Cyclohexane, methyl-, 3135³, 439⁴, 5411⁴.
 3-Heptene, 2149⁹.
 Hexene, methyl-, 30⁴.
 Pentene, ethyl-, 815⁵, 2149⁹.
C₇H₁₄AsCl₂N Arsine, dichloro(β - 1 - piperidylethyl)-, -HCl, 92⁴.
C₇H₁₄AsI₂N Arsine, diiodo(β - piperidylethyl) -, -HI, 92⁴.
C₇H₁₄BrNO See *Neodorm*: *Neodorm*.
C₇H₁₄Br₂ Pentane, 1,2 - dibromo - 3 - ethyl -, 2149⁹.
C₇H₁₄ClN Diethylamine, N - (γ - chloroallyl) -, and -HCl, 2150⁴.
C₇H₁₄ClN₂O₂Pt, 1582².
C₇H₁₄Cl₂ Pentane 1,5 - dichloro - 3,3 - dimethyl-, 4673⁹.
C₇H₁₄Cl₂N₂O₂Pt, 1583³.
C₇H₁₄Cl₂N₂O₂Pt, 1582¹.
C₇H₁₄HgO₂ Pentane, 1-(acetoxymethyl)-, 1871¹.
C₇H₁₄N₂O Heptamethylenimine, 1 - nitroso -, 387⁴.

- C₇H₁₄N₂O₂ 1 - Piperazinecarboxylic acid, Et ester, 2183².
 1 - Piperazinepropionic acid, and *di-HCl*, 2183².
 C₇H₁₄N₂O₂ Glycine, *N*-valyl-, 1112¹; and *Cu salt*, 1618².
 Isovaline, *N*-glycyl-, 4193².
 Valine, *N*-glycyl-, 1389², 1619², 4193².
 C₇H₁₄N₂O₂ Methionamide, *N*, *N'*-diacetyl-, *N*, *N'*-dimethyl-, 98².
 C₇H₁₄N₂S Piperazine, 1 - ethyl-, CS₂ addn. compd., 2183².
 C₇H₁₄N₂O₂ Acetoacetic acid, Et ester, 4-amino-semicarbazone, 5164¹.
 C₇H₁₄O (See also *Cyclohexanol*, *methyl*-.)
 Butyrene, 1872², 4673².
 Cyclohexanecarbinol, 113², 2968².
 Cyclopropanecarbinol, α -ethyl- α -methyl-, 4935².
 Enanthaldehyde, P 1139², 3436¹.
 Ether, ethyl α -ethylallyl, 2416².
 —, ethyl Δ^2 -pentenyl, 2416².
 —, isobutyl propenyl, P 608².
 2-Heptanone, 4440².
 Δ^1 -3-Heptenol, 2695¹.
 Δ^1 -2-Pentenol, 2,4-dimethyl-, 1871².
 C₇H₁₄O₂ (See also *Enanthic acid*.)
 Acetic acid, Am ester, 1969², 3586², 4811², 5395²; isoamyl ester, 2,711², 4335².
 Butyric acid, α , α -dimethyl-, Me ester, 3438².
 1,2-Cyclohexanediol, 1-methyl-, 2095², 2701².
 Cyclohexanol, 2-methoxy-, 3674².
m-Dioxane, 5-ethyl-5-methyl-, 1615².
 2-Hexanone, β -hydroxy-3-methyl-, 4673².
 C₇H₁₄O₂ Butyric acid, α -hydroxy- α , β , β -trimethyl-, 4673².
 Carbonic acid, di-Pr ester, 1058¹.
m-Dioxane, 2- β -methoxyethyl-, 4929².
 5-*m*-Dioxanol, 2-ethyl-2-methyl-(?), 4671¹.
 1,3-Dioxolane-4-carbinol, 2-ethyl-2-methyl-(?), 4671¹.
 2-Pentanone, 1,5-dimethoxy-, 3900².
 Valeric acid, α -hydroxy- α -methyl-, Me ester, 4673².
 C₇H₁₄O₂ 1,3-Dioxolane, α 2 - (α , β -dihydroxy-ethyl)-4-(methoxymethyl)-, 5468².
 Xylose, 2,3-dimethyl-, 5168².
 C₇H₁₄O₂ Fructose, 3-methyl-, 4451².
 Galactide, methyl-, 106².
d-Glucose, methyl-, 3672², 4450².
 Glucoside, methyl-, 106², 821², 1302², 2425², 5080², 5393².
 Sequoyitol, 5469².
 C₇H₁₄O₂ α -Glucoseptulose, 373².
 Rhamnohexonic acid, and *NH₄ salt*, 2942¹.
 C₇H₁₄O₂ Mannoheptonic acid, *NH₄ salt*, 2942¹.
 C₇H₁₄Br See *Heptane*, *bromo*-.
 C₇H₁₄BrHg Heptane, 1-(bromomercuri)-, 1870².
 C₇H₁₄BrHg Heptylmagnesium bromide, 2934².
 C₇H₁₄ClHg Heptane, 1-(chloromercuri)-, 1870².
 C₇H₁₄ClHgPt + 2H₂O, 1582².
 C₇H₁₄ClHgPt, 1581².
 C₇H₁₄HgI Heptane, 1-(iodomercuri)-, 1870².
 C₇H₁₄HgNO₂ Heptane, 1-(hydroxymmercuri)-, nitrate, 1671¹.
 C₇H₁₄N Cyclohexylamine, methyl-, P 846², P 3236².
 Heptamethylenimine, and *chloroplatinate*, 387².
 C₇H₁₄NO 2-Furanpropylamine, tetrahydro-, 387².
 2-Heptanone, oxime, 4440².
 Propionaldehyde, β -diethylamino-, 3209².
 C₇H₁₄NO₂ Actinine, 2451², 2468².
 Enanthic acid, γ -amino-, and -*HCl*, 1617².
 C₇H₁₄NO₂ See *Carnitine*.
 C₇H₁₄NO₂ Rhamnohexonamide, 2941².
 C₇H₁₄NO₂ Mannoheptonamide, 2942².
 C₇H₁₄NS₂ Hexyl alcohol, dithiocarbamate, 4669².
 C₇H₁₄N₂S Biuret, pentamethyldithio-, 1115².
 Pseudourea, α , α , β -trimethylthio- β -dimethylthionocarbamate, 1115².
 C₇H₁₄N₂ Biguanide, α - Δ^2 -isopentenyl-, +H₂SO₄, 4931².
 C₇H₁₄O₂ Propionic acid, α -phosphono-, di-Et ester, *mono-Na salt*, 4444².
 C₇H₁₄ (See also *Heptane*.)
 Butane, trimethyl-, 30², 2928².
 Hexane, methyl-, 30², 2928², 3610².
 Pentane, dimethyl-, 30², 1386², 2928².
 —, ethyl-, 30², 2928².
 C₇H₁₄AsNO₂ Ethaneearsonic acid, 2-(1-piperidyl)-, -*HCl*, 92².
 C₇H₁₄BrN Heptylamine, η -bromo-, and -*HBr*, 387².
 C₇H₁₄Cl₂N₂O₂Pt, 1582², 1583².
 C₇H₁₄Cl₂N₂Pt + H₂O, 1583².
 C₇H₁₄HgO Heptane, 1-(hydroxymmercuri)-, 1870².
 C₇H₁₄N₂ Heptamethylenimine, 1-amino-, and *chloroplatinate*, 387².
 C₇H₁₄N₂O Isovaleramide, *N*-methyl- β -methylamino-, 3207².
 Urea, α , α -dipropyl-, 3442².
 C₇H₁₄N₂O₂ Propionaldehyde, β -methylamino-semicarbazone, acetate, 3209².
 C₇H₁₄N₂O₂ Methionamide, *N*, *N'*-dinitro-, *N*, *N'*-dipropyl-, 98².
 C₇H₁₄N₂S Carbamic acid, (ϵ -guanidoamyl dithio-, 1881².
 C₇H₁₄O Isoheptyl alcohol, 4925².
 C₇H₁₄O₂ Acetone, diethyl acetal, 2639².
 2,4-Pentanediol, 2,4-dimethyl-, 1871².
 C₇H₁₄O₂ Orthoformic acid, tri-Et ester, 2639².
 Propanol, diethoxy-, 5508².
 C₇H₁₄O₂ See *Sulfonal*.
 C₇H₁₄O₂ Glucoheptulitol, 373².
 Sedoheptitol, 4192².
 Volemitol, 4192².
 C₇H₁₄S Sulfide, hexyl methyl, 4669².
 C₇H₁₄AsN₂O₂ 1- ϵ -Propaneearsonic acid, 3-(1-piperazyl)-, *di-HCl*, 92².
 C₇H₁₄AuClN (β -Chloroethyl)diethylmethyl ammonium chloroaurate, 92².
 C₇H₁₄ClN (β -Chloroethyl)diethylmethyl ammonium iodide, 92².
 C₇H₁₄ClN₂O (Ethylcarbamylmethyl) trimethyl ammonium chloride, 3023¹.
 C₇H₁₄ClN (β -Chloroethyl)diethylmethyl ammonium chloride, 92².
 C₇H₁₄N Heptylamine, *hydrohalides*, 2083².
 C₇H₁₄NO 2-Butanol, 1-dimethylamino-2-methyl-, 374².
 Butylamine, γ -propoxy-, 4669².
 1,1-Dimethylpiperidinium hydroxide, 4669².
 1-Heptanol, 7-amino-, and *chloroplatinate*, 387².
 3-Hexanol, 2-methylamino-, and -*HCl*, 4462².
 2-Pentanol, 4-dimethylamino-, 4462².
 C₇H₁₄NO₂ Propionaldehyde, β -ethylamino-, dimethyl acetal, 3209².

- $C_7H_7NO_2S$ Methanesulfonamide, *N*, *N*-dipropyl-, 24277.
 $C_7H_7NO_2$ See *Cholins*, *acetyl*-.
 C_7H_7NS Pseudourea, (diethylaminoethyl)thio-, P 4536⁹.
 $C_7H_7N_2S$ Biguanide, α -isoamyl-, $-H_2SO_4$, 49317.
 $C_7H_7ClO_2N_2O_4 + 4H_2O$, 3868⁹.
 $C_7H_7INO_2$ γ -Hydroxy- β -methoxypropyltrimethylammonium iodide, P 32341.
 $C_7H_7INO_2S$ γ -Hydroxy- β -methoxypropyltrimethylammonium iodide, acid sulfate, P 32341.
 $C_7H_{11}N_2$ 1,3-Butanediamine, N^1, N^1, N^3 -trimethyl-, P 1416⁹.
 Ethylenediamine, *N*, *N*-diethyl-*N'*-methyl-, P 1416⁹.
 $C_7H_{11}NO_2S$ Methionamide, *N*, *N'*-dipropyl-, 987.
 $C_7H_{11}N_2$ Guanidine, α, α' -pentamethylenebis-, 1115⁹; and salts, 1881².
 $C_7H_{11}N_2S$ Guanidine, α, α' -1,4-butylenebis-, trithiocarbonate, 1881².
 $C_7H_7ClNO_2P$ β -Hydroxyethyltrimethylammonium chloride, ester with dimethyl phosphate, 1874⁹, 3023².
 $C_7H_{11}NO$ Butyltrimethylammonium hydroxide, 2419⁹, 4669⁷.
 $C_7H_{11}ITe$ Trimethyltelluronium iodide, compd. with MeTeI, 2933⁹.
 $C_7H_{11}Li_2N$ Addn. compd. from LiI and MeNH₂, 2118⁹.
 $C_7H_7BrCl_2N$ Ethylene, 1-bromo-2,2-dichloro-1-(2,4,6-trichlorophenylazo)-, 824⁴.
 $C_7H_7BrCl_3N$ Ethylene, 1,1,2-trichloro-2-(2,4,6-tribromophenylazo)-, 824⁴.
 $C_7H_7BrCl_2N$ Ethylene, 1-bromo-2,2-dichloro-1-(2,4,6-tribromophenylazo)-, 824⁴.
 $C_7H_7Cl_3N$ Ethylene, 1,1,2-trichloro-2-(2,4,6-trichlorophenylazo)-, 824⁴.
 $C_7H_7BrO_2$ Phthalic anhydride, 4-bromo-, 3457⁹.
 $C_7H_7Br_2Cl_2N$ Ethylene, 1,1-dichloro-2-(2,4,6-tribromophenylazo)-, 824⁴.
 $C_7H_7Br_2NO_2$ Styrene, 3,4,5-tribromo- β ,2-dinitro-, 1890⁹.
 $C_7H_7ClO_2$ Phthalic anhydride, 4-chloro-, 3457⁹.
 $C_7H_7Cl_2N$ Ethylene, 1,1-dichloro-2-(2,4,6-trichlorophenylazo)-, 824⁴.
 $C_7H_7Cl_2N$ Acetyl chloride, trichloro-, (2,4,6-trichlorophenyl)hydrazone, 824⁴.
 $C_7H_7FO_2$ Phthalic anhydride, 4-fluoro-, 3457⁹.
 $C_7H_7IO_2$ Phthalic anhydride, iodo-, 3457⁹.
 $C_7H_7N_2O_2$ 2-Benzisoxazolecarbonyl azide, 5-nitro-, 3973⁹.
 $C_7H_7Cl_2N$ Phthalazine, 1,4-dichloro-, P 5197⁴.
 $C_7H_7Cl_2NO_2$ α -Tolunitrile, α, α -dichloro- p -nitro-, 3218⁹.
 $C_7H_7Cl_2O_2$ See *Phthalyl chloride*.
 $C_7H_7Cl_2NO_2$ Glyoxylic acid, chloro-, (2,4,6-trichlorophenyl)hydrazone, 824⁴.
 $C_7H_7HgO_2$ Terephthalic acid, 2-(hydroxymercuri)-, anhydride, 4943⁹.
 $C_7H_7KNO_2$ Phthalimide, K deriv., 2938⁹.
 $C_7H_7NaNO_2$ Isatin, Na deriv., 2970⁹.
 Phthalimide, Na deriv., P 1418⁹.
 $C_7H_7N_2O_2$ 2-Benzisoxazolecarboxylic acid, 5-nitro-, 3973⁹.
 $C_7H_7N_2O_2$ 2,3,5,6-Pyrazinetetracarboxylic acid, and *di-K salt*, 3473⁹.
 $C_7H_7O_2S$ Phthalic anhydride, thio-, 127⁴.
 $C_7H_7O_2$ See *Phthalic anhydride*.
 $C_7H_7BrClNO_2$ α -Tolyl chloride, α -bromo- p -nitro-, 4468⁹.
 $C_7H_7BrN_2$ Quinoxaline, 6-bromo-, 3473⁹.
 $C_7H_7BrN_2O_2$ α -Tolunitrile, bromonitro-, 2951^{2,5}.
 $C_7H_7BrO_2$ Piperonal, 6-bromo-, 4204⁴.
 $C_7H_7BrO_2$ Phthalic acid, bromo-, 6001, 1401⁴.
 Terephthalic acid, 2-bromo-, 4943⁹.
 $C_7H_7Br_2NO_2$ Anisonitrile, 2,6-dibromo-, 36751.
 $C_7H_7Br_2NO_2$ α -Tolyl bromide, α -bromo- p -nitro-, 4463⁹.
 $C_7H_7Br_2N_2O_2$ Glyoxylic acid, (2,4,6-tribromophenyl)hydrazone, 824⁴.
 $C_7H_7ClHgO_2$ Terephthalic acid, 2-(chloromercuri)-, 4943⁹.
 $C_7H_7ClN_2$ Quinoxaline, 6-chloro-, 3473⁹.
 $C_7H_7ClN_2O_2$ 1,2,4-Oxadiazole, 3-chloro-5-phenyl-, 4447².
 $C_7H_7ClO_2$ Piperonal, 6-chloro-, 4204⁴.
 $C_7H_7Cl_2NO_2$ α -Toluic acid, α, α -dichloro- p -nitro-, 3218⁹.
 $C_7H_7Cl_2N_2O_2$ Glyoxylic acid, (2,4,6-trichlorophenyl)hydrazone, 824⁴.
 $C_7H_7Cl_2N_2O_2$ Benzaldehyde, 3,4,5-trichloro-2-nitro-, semicarbazone, 1891⁴.
 $C_7H_7Cl_2O_2$ p -Toluic acid, α -trichloro-, P 4950⁹.
 $C_7H_7FO_2$ Phthalic acid, 4-fluoro-, 3457⁹.
 $C_7H_7IO_2$ Phthalic acid, 3-iodo-, 1401⁴.
 C_7H_7NOS Benzaldehyde, isothiocyano-, 1718⁹.
 $C_7H_7NO_2$ (See also *Isatin*).
 Benzoic acid, cyano-, 5390¹.
 $C_7H_7NO_2S$ Thionaphthene, 2-nitro-, 3468⁹.
 $C_7H_7NO_2$ Piperonal, 6-nitro-, 1404⁹, 4204⁴.
 $C_7H_7NO_2$ Phthalic acid, 3-nitro-, 1401⁴.
 $C_7H_7NO_2S$ Phenylsulfuric acid, *o*(and *p*)-nitro-, *K salt*, 2160⁷.
 $C_7H_7NNaO_2$ 2,3-Quinoxalinediol, mono-Na deriv., 141⁷.
 $C_7H_7N_2O_2$ Compd., m. 204⁹, from 5-amino-1,4-benzisoxazin-3-ol, 840⁹.
 Dinicotinonitrile, 2,6-dihydroxy-4-methyl-, ammonium salt, 3668⁴.
 $C_7H_7N_2O_2$ Acetophenone, α -diazo- p -nitro-, 826⁹.
 $C_7H_7AsCl_2NO_2$ Acetic acid, α -dichloroarsyl-2-nitrophenoxyl-, 841³.
 $C_7H_7AsNO_2$ 1,4-Benzisoxazin-3-ol, 6-arsinazo-, 841³.
 $C_7H_7AsN_2O_2$ Compd., m. 247⁹, from 5-amino-3-hydroxy-1,4-benzisoxazine-6-arsonic acid, 841³.
 C_7H_7BrClO α -Tolyl chloride, α -bromo-, 4463⁴.
 C_7H_7BrNS Benzothiazole, 5-bromo-1-methyl-, 390⁹.
 $C_7H_7BrN_2O_2$ Benzaldehyde, 2-bromo-4-hydroxy-3,5-dinitro-, semicarbazone, 1893⁹.
 Salicylaldehyde, 4-bromo-3,5-dinitro-, semicarbazone, 1893⁹.
 $C_7H_7Br_2S_2I$ Di- α -thienylthallic bromide, 46991.
 $C_7H_7Br_2O$ Acetophenone, p , α -dibromo-, 2164⁴.
 Toluyl bromide, α -bromo-, 1381, 4463⁴.
 $C_7H_7Br_2O_2$ Anisaldehyde, 3,5-dibromo-2-hydroxy-, 4682¹.
 $C_7H_7Br_2S_2Te$ Di-2-thienyltellurium dibromide, 4699².
 C_7H_7ClNO Benzonitrile, chloro-2-methoxy-, 1128⁹.
 $C_7H_7ClNO_2$ p -Tolyl chloride, 3-nitro-, 2935¹.
 C_7H_7ClNS Benzothiazole, chloromethyl-, 390⁹.
 $C_7H_7ClN_2O_2$ Benzaldehyde, 2-chloro-4-hydroxy-3,5-dinitro-, semicarbazone, 1893⁹.

- Salicylaldehyde, 4 - chloro - 3,5 - dinitro -, semicarbazone, 1893².
- C₆H₄Cl₂FN₂O** Acetanilide, 2,4 - dichloro - 5 - fluoro-, 5170².
- C₆H₄Cl₂O**, *m* - Toluyl chloride, α - chloro -, 138².
- C₆H₄Cl₂O₂** Toluic acid, dichloro-, P 1511⁷.
- C₆H₄Cl₂Se** Di - 2 - thienyltellurium dichloride, 4699².
- C₆H₄Cl₂N₂O** Benzaldehyde, 3,4,5 - trichloro -, semicarbazone, 1891⁴.
- C₆H₄Cl₄**, Xylene, tetrachloro-, P 3233², 3674².
- C₆H₄Cl₂** Benzene, compd. with CCl₄, 2641⁴.
- C₆H₄FeHg₂O₂**, 4417².
- C₆H₄HgN₂O** Phenol, (acetoxymercuri) dinitro-, 3216².
- C₆H₄IN₂O** Benzaldehyde, 4 - hydroxy - 2 - iodo - 3,5 - dinitro -, semicarbazone, 1894².
- Salicylaldehyde, 4 - iodo - 3,5 - dinitro -, semicarbazone, 1894².
- C₆H₄I₂Se**, Di - 2 - thienyltellurium diiodide, 4699².
- C₆H₄KN**, α -Tolunitrile, K deriv., 828⁴.
- C₆H₄N**, 1,5 - Pyridopyridine, and salts, 2712².
- Quinoxaline, mono-tetrachloroiodide, 3473².
- C₆H₄N₂O** Benzoyl cyanide, *N*-oxide, oxime 4447².
- 1,2,3,6 - Dioxidiazine, 4 - phenyl -, 4447².
- 3-Furazanol, 4-phenyl-, 4447².
- Furoxan, 3(and 4) - phenyl -, 4447².
- 2,3 - Quinoxalinediol, 141⁷.
- α -Tolunitrile, *p*-nitro-, 3218².
- C₆H₄N₂O**, 1,4 - Benzisoxazin - 3 - ol, nitro -, 840², 841¹.
- C₆H₄N₂O** Oxanilic acid, nitro-, P 2988².
- C₆H₄N₂**, 2,5 - Pyrazinedinitrile, 3,6 - dimethyl -, 602².
- C₆H₄N₂O**, 2 - Benzisoxazolecarboxylic acid, 5 - nitro-, hydrazide, 2973².
- C₆H₄N₂O** See *Alloxantin*.
- C₆H₄OTe** 3-Telluronaphtheneol, 2956².
- C₆H₄O** Glyoxal, phenyl-, 602².
- Phthalide, 3394².
- C₆H₄O₂**, 2-Benzothioxolone, 5-methyl-, 2245².
- C₆H₄O** See *Piperonal*.
- C₆H₄O₂** Phthalic acid, thiol-, 127⁴.
- C₆H₄O** (See also *Phthalic acid*.)
- Bicyclo[2.2.1] - 7 - oxo-5 - heptene - 2,3 - dicarboxylic anhydride, 1647², 3691².
- C₆H₄O**, Piperonylic acid, 6 - hydroxy -, 1404².
- Terephthalic acid, 2-hydroxy-, 135².
- C₆H₄O**, Terephthalic acid, 2,6 - dihydroxy -, and mono - NH₂ salt, 1126².
- C₆H₄S** Thionaphthene, 3468².
- C₆H₄Se** Tellurium di-2-thienyl, 4699².
- C₆H₄Se** Selenonaphthene, 2417².
- C₆H₄AsClNO**, 1,4 - Benzisoxazine - 6 - arsonic acid, 8 - chloro - 3 - hydroxy -, 841².
- C₆H₄As₂N₂O**, 1,4 - Benzisoxazin - 3 - ol, 8 - amino-6-arsinoso-, -HCl, 841².
- C₆H₄As₂N₂O** Acetanilide, 5 - arsinoso - 2 - hydroxy-3-nitro-, 119².
- 7 - Quinoxalinecarsonic acid, 1,2,3,4 - tetrahydro - 2,4 - diketone, P 147⁴, 2426².
- Quinoxalinecarsonic acid, 2,3 - dihydroxy -, and salts, 2430².
- C₆H₄As₂N₂O**, 1,4 - Benzisoxazinecarsonic acid, 3-hydroxynitro-, 841², 842².
- C₆H₄Br**, Styrene, *p*-bromo-, 2157², 3908².
- C₆H₄Br₂FN₂O** Benzaldehyde, 3 - bromo - 2 - fluoro - 4 - hydroxy -, semicarbazone, 5177².
- C₆H₄BrMgO**, Carbonic acid, benzyl ester, bromomagnesium salt, 4925².
- C₆H₄BrN₂O**, α - Toluamide, α - bromo - *p* - nitro-, 4463².
- C₆H₄BrN₂O**, Aniline, 6 - bromo - *N* - methyl - 3,4 - methylenedioxy - 2 - nitro -, 4204².
- C₆H₄BrN₂S** Benzothiazole, 1 - amino - 5 - bromo - 3 - methyl -, -HBr, 835².
- C₆H₄BrN₂O** Benzaldehyde, 2 - bromo - 4 - hydroxy - 5 - nitro -, semicarbazone, 1893².
- Salicylaldehyde, 4 - bromo - 5 - nitro -, semicarbazone, 1893².
- C₆H₄BrO** Acetophenone, α -bromo-, 2171⁴.
- C₆H₄BrO** Acetophenone, α -bromo-*p*-hydroxy-, P 2723².
- C₆H₄BrO**, Anisaldehyde, 5 - bromo - 2 - hydroxy-, 4681².
- C₆H₄BrNO**, Anisaldehyde, 3,5 - dibromo - 2 - hydroxy-, oxime, 4682².
- C₆H₄Br** Benzene, 1 - bromo - 4 - (α , β - dibromomethyl)-, 2157².
- C₆H₄BrN₂S** Benzothiazole, 1 - amino - 5 - bromo - 3 - methyl -, dibromide, -HBr, 835².
- C₆H₄Cl₂FN₂O** Acetanilide, chlorofluoro-, 5170².
- C₆H₄Cl₂HgN₂O** Terephthalamide, 2 - (chloromercuri)-, 4943².
- C₆H₄Cl₂N₂O** See *Stibosan*.
- C₆H₄Cl₂N₂O** Acetanilide, α - chloro - 2 - hydroxy nitro-, 840², 841¹.
- C₆H₄Cl₂N₂O** Benzaldehyde, 2 - chloro - 4 - hydroxy-5-nitro-, semicarbazone, 1893².
- Salicylaldehyde, 4 - chloro - 5 - nitro -, semicarbazone, 1893².
- C₆H₄ClO** Acetophenone, *m* - chloro -, 3218².
- α -Toluy chloride, 5178¹.
- C₆H₄ClO** Formic acid, chloro-, *p*-tolyl ester, 2430².
- C₆H₄ClO**, Acetophenone, α - chloro - 3,4 - dihydroxy-, 2161².
- Benzoic acid, 5-chloro-2-methoxy-, 1128².
- Vanillin, 5-chloro-, 4456².
- C₆H₄Cl₂KN₂O** 2,4 - Xylidine, 3,5 - dichloro - *N*-nitroso-, K deriv., P 2190², P 4710².
- C₆H₄Cl₂N₂O**, *m* - Xylene, 2,4 - dichloro - 6 - nitro-, P 1649².
- C₆H₄Cl₂** Xylene, trichloro-, P 3233², 3674².
- C₆H₄Cl₂O** 2,5 - Xylenol, 3,4,6 - trichloro -, 3674².
- C₆H₄Cl₂O₂** 2,4 - Xylenesulfonic acid, trichloro -, P 3233².
- C₆H₄FN₂O** Benzaldehyde, 2 - fluoro - 4 - hydroxy - 5 - nitro -, semicarbazone, 5177².
- C₆H₄FO**, Anisaldehyde, 2 - fluoro -, 5177².
- Benzaldehyde, 4 - fluoro - 2 - methoxy -, 5177².
- C₆H₄FO**, Anisic acid, 2-fluoro-, 5177².
- Benzoic acid, 4 - fluoro - 2 - methoxy -, 5177².
- C₆H₄HgN₂O** Phenol, 2 - (acetoxymercuri) - 3 - nitro-, 3216².
- C₆H₄IN₂O** Benzaldehyde, 4 - hydroxy - 2 - iodo - 5 - nitro -, semicarbazone, 1894².
- Salicylaldehyde, 4 - iodo - 5 - nitro -, semicarbazone, 1894².
- C₆H₄IO** Benzoic acid, 2-iodo - 3 - methoxy -, 129².
- C₆H₄IN₂S** 1 - Iodo - 2 - methylbenzothiazolium iodide, 389².
- C₆H₄IN** (See also *Indols*.)
- Pseudoindole, 3928².
- Pseudoindole, 2175².
- Tolunitrile, 1815², 4639².
- C₆H₄NO** Mandelonitrile, 599², 3710².

- o-Tolunitrile, α - hydroxy -, P 1724⁵.
C₈H₇NO₃S Cresol, thiocyanato-, 2245³.
C₈H₇NO₂ Styrene, β -nitro-, 2157¹.
C₈H₇NO₂ Acetophenone, o-nitro-, 3452⁶.
 2(1) - Benzisoxazolone, 1 - (hydroxymethyl) -, 1126³.
 Ethylene oxide, (*p* - nitrophenyl) -, 2442³.
 Glyoxylic acid, phenyl-, oxime, *derivs.*, 4693^{1,2}.
 Phthalamic acid, P 608³.
C₈H₇NO₃S Saccharin, 1-methyl-, 4701⁸.
C₈H₇NO₂ Pyrocatechol, 4 - (β -nitrovinyl)-, 5162³.
C₈H₇NS Benzothiazole, 1-methyl-, *salts*, 142⁸.
 Isothiocyanic acid, o-tolyl ester, 3445⁶.
 2-Thionaphtheneamine, 3468⁸.
C₈H₇NS 2(1) - Benzisothiazolone, 1 - methylthio-, 4701⁸.
C₈H₇NS Benzoselenazole, 1 - methyl-, and chloroplatinate, 142⁷.
C₈H₇N₂ 1,3,4 - Triazole, 1 - phenyl-, 836⁴.
C₈H₇N₂OS Carbazalddehyde, β - *p* - thiocyanophenyl-, 2245².
 1,3,4 - Thiodiazolid - 2 - one, 5 - phenylimino -, 2974⁸.
C₈H₇N₂O₂ 1,2,3,6 - Dioxdiazine, 4 - amino - 5 - phenyl - (?), 133².
 Furazan, 3 - amino - 4 - phenyl - (?), oxide, 133².
 Phthalic acid, amino-, hydrazide, 4889⁷.
C₈H₇N₂O₄ *m* - Xylene, 2,4,6 - trinitro-, 2349², 3214^{3,4}.
C₈H₇N₂O₄ Veratrole, 3,4,5 - trinitro-, 5174².
C₈H₇ (See also *Styrene*).
 Protostyrene, 2948⁷.
C₈H₇AsClN₂O₂ 1,4 - Benzisoxazin - 3 - ol, 8 - amino - 6 - (chlorohydroxyarsyl)-, -HCl, 841⁷.
C₈H₇AsClN₂O₂ *m* - Arsanilic acid, *N* - chloroacetyl - 4 - hydroxy - 5 - nitro -, 841⁷.
C₈H₇AsClN₂O₂ Acetanilide, dichloroarsylhydroxy-, 119⁹.
C₈H₇AsN₂O₂ Phenomorpholine, 6 - arsinoso -, 842⁷.
C₈H₇AsN₂O₂ Acetanilide, arsinoso hydroxy -, 119⁹, P 1649⁹.
C₈H₇AsN₂O₂ 1,4 - Benzisoxazincarbonic acid, hydroxy -, 841⁷, 842⁷, P 2186⁹.
C₈H₇AsN₂O₂ 1,4 - Benzisoxazine - 6 - arsonic acid, 3,7 - dihydroxy -, 841⁷.
C₈H₇BrNO Acetanilide, o-bromo-, 823⁷.
C₈H₇BrNO Anisaldehyde, 5 - bromo - 2 - hydroxy-, oxime, 4681⁷.
C₈H₇BrN₂O₂ Protocatechualdehyde, 6 - bromo -, semicarbazone, 4204⁷.
C₈H₇BrN₂O₂ Aniline, 4 - bromo - *N,N* - dimethyl - 2,6 - dinitro -, 117⁹.
C₈H₇BrN₂S Benzothiazole, 1 - amino - 3 - methyl -, dibromide, -HBr, 835⁴.
C₈H₇BrN₂S Benzothiazole, 1 - amino - 3 - methyl -, tetrabromide, 835⁴.
C₈H₇ClNO *m*-Xylene, chloronitro-, P 1649⁹.
C₈H₇ClNO₂S Benzisulfonazole, 6 - chloro - 1,2 - dihydro - 1 - methyl -, 2164².
C₈H₇ClNO₂ Phenetole, 2 - chloro - 4 - nitro -, 117⁹.
 3,4 - Xylenol, 6 - chloro - 2 - nitro -, 116³.
C₈H₇ClNO₂S Sulfone, 5 - chloro - 2 - nitro - *p* - tolyl methyl, 3665¹.
C₈H₇Cl₂ *m* - Xylene, 2,4 - dichloro -, P 3233⁴.
C₈H₇Cl₂HgO₂ Resorcinol, bis(chloromercuri) - 4-ethyl-, 1401¹.
C₈H₇Cl₂N₂O Benzaldehyde, 4 - amino - 3,5 - dichloro -, semicarbazone, 1891⁴.
C₈H₇Cl₂O Xylenol, dichloro-, 116³, 117⁴.
C₈H₇Cl₂O₂S 2,4 - Xylenesulfonic acid, dichloro-, P 3233⁴.
C₈H₇Cl₃N 2,5 - Xylidine, 3,4,6 - trichloro -, 3674⁸.
C₈H₇CuO₂ Methyl hydroxycuprisalicylate, 829³.
C₈H₇FNO Acetanilide, *m*-fluoro-, 5170¹.
C₈H₇FNO₂ Anisaldehyde, 2 - fluoro-, oxime, 5177⁴.
 Benzaldehyde, 4 - fluoro - 2 - methoxy -, oxime, 5177⁴.
C₈H₇FN₂O₂ Benzaldehyde, 2 - fluoro - 4 - hydroxy -, semicarbazone, 5176³.
 Salicylaldehyde, 4 - fluoro -, semicarbazone, 5176³.
C₈H₇HgO₂S Acetic acid, phenylmercurimercapto-, 3982⁷.
C₈H₇HgO₂ Resorcinol, anhydromercurihydroxymercuriethyl-, 1401¹.
C₈H₇K₂N₂O₂S₂Th, 2119⁴.
C₈H₇N₂ Benzimidazole, 2-methyl-, 141⁸.
C₈H₇N₂O 2-Benzimidazolecarbinol, 141⁸.
C₈H₇N₂OS 1(2) - Benzothiazolone, 2 - methyl -, oxime, 389⁷.
C₈H₇N₂O₂ 1,4 - Benzisoxazin - 3 - ol, amino-, and -HCl, 840⁹, 841¹, 842².
 Glyoxime, phenyl-, 4471².
 2,3 - Pyranopyrazol - 6(1) - one, 3,4 - dimethyl-, 5164².
C₈H₇N₂O₂S Benzothiodiazole, 4,5 - dimethoxy -, 3467⁸.
C₈H₇N₂O₂ Acetanilide, nitro-, 2345⁶, 4198⁷.
 Benzoic acid, carbamido-, 3442⁷.
C₈H₇N₂O₂ Aniline, *N* - methyl - 4,5 - methylenedioxy-2-nitro-, 4204⁷.
 2,5 - Pyrazinedicarboxylic acid, 3,6 - dimethyl-, 602⁴.
C₈H₇N₂O₂ Anisole, 5 - methyl - 2,4 - dinitro -, 1887².
C₈H₇N₂O₂ Veratrole, dinitro-, 3219⁴, 4205¹, 5174^{1,4}.
C₈H₇NS Benzothiazole, 1 - amino - 3 - methyl -, -HBr, 835⁴.
C₈H₇N₂O Benzoxazole, 1-guanido-, 5165¹; and *salts*, 4449⁹.
C₈H₇N₂O₂ Protocatechualdehyde, 6 - nitro -, semicarbazone, 4204⁷.
C₈H₇N₂O₂ Picramide, 3,5 - dimethoxy -, 823⁴.
C₈H₇N₂S 1,3,4 - Thiodiazole, 2 - β - phenylhydrazino-, 1397².
 1,2,4 - Triazol - 3(2) - one, 4,5 - dihydro - 5-imino-4-phenylthio-, 1639⁹.
C₈H₇N₂S 1,3,4 - Thiodiazole - 2 - mercaptan, 5 - β - phenylhydrazino-, 1398⁴.
 1,3,4 - Thiodiazol - 2(3) - one, 5 - β - phenylhydrazino-2-thio-, 1398¹.
C₈H₇N₂O 1,2,3,4 - Tetrazole, 5 - β - phenylcarbamido-, 4471².
C₈H₇NiO Methyl hydroxynickelosalicylate, 829³.
C₈H₇O See *Acetophenone*.
C₈H₇O₂ (See also *Salicylic acid*)
 Anisaldehyde, P 2446⁹.
 Benzaldehyde, o - methoxy -, 2056⁷.
 1,3-Benzodioxan, 2182⁹.
 Benzoic acid, Me ester, 1348⁸, 2081³, 5182².
 Benzyl alcohol, formate, P 1138¹.
 1,6-Dioxeca-3,8-diene, 2716⁹.
m-Xyloquinone, 1122².
C₈H₇O₂ (See also *Mandelic acid*; "methyl ester" under *Salicylic acid*, *Vanillin*).
 Acetic acid, phenoxy-, 3571⁹.
 Acetophenone, 3,4-dihydroxy-, 2161⁴.
 Anisic acid, 590¹, 1126⁶.

- Benzoic acid, *p* - hydroxy -, Me ester, 1471¹.
 Furanacrylic acid, Me ester, 3993⁷.
 Glyoxal, phenyl-, hydrate, 3249¹.
 Isovanillin, 2676⁴, 4462².
 Solbrol, 3516⁴.
 C₆H₅O₂S β-Styrenesulfonic acid, 1628⁴.
 C₆H₅O₂ Bicyclo[2.2.1] - 7 - oxahепtane - 2,3 - dicarboxylic anhydride, 1647⁴, 3691¹.
 2 - Furaldehyde, hydroxymethyl-, acetate, 2175⁴.
 2 - Furanacrylic acid, hydroxymethyl -, 2175⁴.
 Homogentisic acid, 2705⁷, 2998³, 3936⁴.
 Phloracetophenone, 1403³, 2431⁴.
p - Toluic acid, 2,3,5 - trihydroxy -, 4477⁷.
p - Toluic acid, 3,5 - dihydroxy -, 135⁴.
 C₆H₅O₂ Methronic acid, 3926⁴.
 Protocatechuic acid, 5-methoxy-, 3914⁴.
 1,2 - Pyran - 4 - carboxylic acid, 2 - keto - 6-methoxy-, Me ester, 1879³.
 C₆H₅O₂ Toluic acid, dithio-, 4939⁷.
 C₆H₅AsBrNO₂ Arsanilic acid, *N*-acetyl - 2 - bromo-, 3677⁴.
 C₆H₅AsBrNO₂ *m* - Arsanilic acid, *N* - acetyl - 5-bromo-4-hydroxy-, 1400⁴.
 C₆H₅AsClNO₂ *m* - Arsanilic acid, *N* - acetyl - 6-chloro-4-hydroxy-, P 2448⁴.
 C₆H₅AsCl₂N₂O₂ Acetanilide, 3 - amino - 5 - dichloroarsyl - 2 - hydroxy -, -HCl, 119⁴.
 C₆H₅AsI₂N₂O₂ Acetanilide, aminodiodoarsyl-hydroxy-, -HI, 119⁴.
 C₆H₅AsN₂O₂ Acetanilide, aminoarsinoso-hydroxy, salts, 119⁴.
 Benzimidazolecarsonic acid, methyl-, and salts, 2429⁴.
 C₆H₅AsN₂O₂ 1,4 - Benzisoxazinearsonic acid, aminohydroxy-, 841⁴, 842⁴, P 2186⁴.
 C₆H₅AsN₂O₂ Benzenearsonic acid, 3,5 - diformamido - 4 - hydroxy -, 1400⁴.
 C₆H₅AsN₂O₂ *m* - Arsanilic acid, *N* - acetyl - 6 - hydroxy-5-nitro-, 119⁴.
 C₆H₅AsN₂O₂ Arsanilic acid, *N* - glycolyl - 3 - hydroxy - 2 - nitro -, 842⁴.
 C₆H₅BrN₂O₂ Aniline, 4 - bromo - *N,N* - dimethyl-3-nitro-, 117⁴.
 C₆H₅BrO Benzyl alcohol, *p* - bromo - *o* - methyl-, 2157⁴.
 C₆H₅BrNO Anisidine, dibromo - *N* - methyl -, 3675⁴.
 C₆H₅Cl Benzene, (*β* - chloroethyl-), 2715⁴.
m-Xylene, 2-chloro-, P 3233⁴.
 C₆H₅ClHgO Phenetole, *p* - (chloromercuri) -, 5172⁴.
 C₆H₅ClHgO Resorcinol, 4 - (chloromercuri) - 6-ethyl-, 1401³.
 C₆H₅ClO Ether, benzyl chloromethyl, P 612², 1871¹.
 3,4-Xylenol, 2-chloro-, 116⁴.
 C₆H₅ClO₂ 2,4-Xylenesulfonic acid, 3-chloro-, P 3233⁴.
 C₆H₅Cl₂N Aniline, 2,4 - dichloro - *N,N* - dimethyl-, P 606⁴.
 2,4 - Xyldine, 3,5 - dichloro-, P 5475⁴.
 C₆H₅Cl₂N *p* - Phenetidine, dichloro-, 1629⁴, 1830⁴, 1889⁴; and salts, 3910⁴, 3911⁴.
 C₆H₅IO Anisole, 3-iodo-4-methyl-, 3706⁴.
 C₆H₅KN *p*-Toluanidine, K salt, 599⁴.
 C₆H₅N Benzylamine, *N*-methylene-, 4461⁴.
p-Indole, 2,5-dihydroxy-, 3714⁴.
 Indoline, 2715⁴, 4215⁴.
 Methylamine, *N*-benzyl-, 4461⁴.
 C₆H₅NO (See also *Acetanilide*.)
 Acetophenone, oxime, 1348⁴, 3681¹.
 Benzaldehyde, *O*-methyloxime, 4857⁷.
 C₆H₅NO₂ Anisaldehyde, oxime, 3676⁴.
 Anthranilic acid, Me ester, 318⁴.
 Benzaldehyde, *o*-methoxy-, *α*-oxime, 3681¹.
 Benzoic acid, amino-, Me ester, 318⁴, 1404⁴, 1471¹.
 Pyrrole, 2,5 - diacetyl-, compds. with *Sn tarahalides*, 2968⁷.
α-Toluic acid, *α*-amino-, 4942⁴.
 Toluquinonimine, methoxy-, 1402⁴.
 3,5-Xylenol, nitroso-, 1122⁴.
 C₆H₅NO₂S Benzisoxulfonazole, 1,2-dihydro-1-methyl-, 4680⁴.
 C₆H₅NO₂S Anisole, 4-methylnitro-, 2430⁷.
 Benzylideneoxime, methyl-3,4-dihydroxy-, 5182⁴.
 Carbanilic acid, *o*-hydroxy-, Me ester, 4940⁴.
 Ether, methyl *p*-nitrobenzyl, 3919⁴.
 Orthoform-new, 1471¹.
 C₆H₅NO₂S Benzenesulfonamide, *p*-formyl - *N* - methyl-, 4860⁴.
 2 - Benzenesulfonazolol, 1,2 - dihydro - 1 - methyl-, 4680⁴.
 C₆H₅NO₂ Phenol, *p* - amino -, oxalate, 5154⁴.
 C₆H₅NO₂S Benzenesulfonic acid, *p*-nitro-, Et ester, 830⁴.
 C₆H₅NO₂S Biuret, 1-phenyl-4-thio-, 3903⁴.
 C₆H₅NO₂S Biuret, 1-phenyl-, 3442⁴, 4194⁴.
 Formamide, *p*-anisylazo-, 4679⁴.
 C₆H₅N₂O₂S Carbazic acid, β-(*o*-nitrophenyl)di-thio-, Me ester, 380⁴.
 C₆H₅N₂O₂ *m* - Toluidine, *N* - methyl - 4,6 - dinitro-, 1887⁴.
 C₆H₅N₂S 1,2,4 - Benzotriazine, 1,4 - dihydro - 3 - methylmercapto-, and -HCl, 380⁴.
 C₆H₅ (See also *Benzene*, *ethyl*-, *Xylene*.)
 Fulvene, dimethyl-, 4465⁴.
 C₆H₅AsCl₂N₂O₂ Arsanilic acid, *N* - (carbamyl-methyl) - 2 - chloro -, P 1141⁴.
 C₆H₅AsN₂O₂ Acetanilide, arsylhydroxy-, 120⁴.
 C₆H₅AsNO₂ 6 - Phenomorpholinearsonic acid, 842⁴.
 C₆H₅AsN₂O₂ Acetarsonic acid, 1400⁴.
 Benzenearsonic acid, acetamidohydroxy -, *NH*, salt, P 1216⁴.
 C₆H₅AsNO₂ *m* - Arsanilic acid, *N* - acetyl - 4,6-dihydroxy-, 841⁴.
 C₆H₅AsN₂NaO₂ See *Trypsaramide*.
 C₆H₅BrMgN *p* - Dimethylaminophenylmag-nesium bromide, 132⁴.
 C₆H₅BrNO₂ Aniline, 3 - bromo - 2,6 - dime-thoxy-, 1401⁴.
 C₆H₅BrO₂ 1,2 - Cyclohexanedicarboxylic acid, 3,6-dibromo-, 3691⁴.
 C₆H₅ClN Aniline, *o*-chloro - *N,N* - dimethyl -, P 606⁴.
 Aniline, *p*-(β-chloroethyl-), 2715⁴.
 Benzylamine, *p* - chloro - *N* - methyl -, and -HBr, 4460⁴.
 2,4 - Xyldine, 3 (and 5) - chloro -, P 5475⁴.
 C₆H₅Cl₂N *m* - Anisidine, chloro - 6 - methyl -, 3706⁴.
 Xylenol, aminochloro-, 116⁴.
 C₆H₅Cl₂N₂ 1 - (Hydroxymethyl)pyridinium chloride, acetate, 3022⁷.
 C₆H₅Cl₂N₂ 1,2 - Cyclohexanedicarboxylic acid, 3,6-dichloro-, 3691⁴.
 C₆H₅Cl₂N₂ 3 - Carbonyl - 1 - methylpyri-dinium tetrachlorodide, Me ester, 4476⁴.
 C₆H₅FeNO Addn. compd. of H₂Fe(CN)₄ · 3H₂O, 3638⁴.
 C₆H₅NO 1-Allylpyridinium iodide, 1902¹.

- $C_8H_9INO_3$ 3 - Carboxy - 1 - methylpyridinium iodide, Me ester, 3022¹.
- $C_8H_9NO_3Sb$ Sodium salt—see *Stibenyl*.
- $C_8H_9NO_3Sb$ Carbanilic acid, *p* - stibono -, Me ester, 598².
- $C_8H_9N_2O$ Acetanilide, *p* - amino -, $\alpha ZnCl_2$ salt, P 2722².
- Aniline, *N, N* - dimethyl - *p* - nitroso -, 378¹, 1636², 4940³.
- 4 - Cinnolinol, 1, 2, 3, 4 - tetrahydro -, 4700².
- Glycinanilide, 1112².
- α -Toluamide, *o*-amino-, 4700².
- Urea, α -methyl- α -phenyl-, 1889², 3442².
- , *p*-tolyl-, 1889².
- $C_8H_9N_2O_2$ Phenethylamine, *m*-nitro-, -HCl, 5186².
- 2, 5-Pyrazinedicarboxamide, α 3, 6-dimethyl-, 6024².
- $C_8H_9N_2O_4$ Aniline, 4, 5 - dimethoxy - 2 - nitro -, 4204², 5174².
- Ethanol, 2 - (2 - amino - 4 - nitrophenoxy) -, P 4949².
- $C_8H_9N_2S$ Urea, *o*-tolylthio-, 3445².
- $C_8H_9N_2O_2$ (See also *Caffeine*.)
- Allophanic acid, β -phenylhydrazide, 4194².
- $C_8H_9N_2O_3S$ 2, 4(3, 5) - Thiazolodione, 5 - methyl-, 2, 2' - azine, 6014².
- $C_8H_9N_2O_4$ Urea, α - ethyl - α - nitro - β - 2 - pyridyl-, 32274².
- $C_8H_9N_2O_2$ Quinone, disemicarbazone, 4679².
- C_8H_9O (See also *Phenethyl alcohol*; *Phenetole*.)
- Anisole, methyl-, 18964², 54114².
- Benzyl alcohol, α -methyl-, 21714².
- Furan, 2 - (2 - methylcyclopropyl)-, 4698².
- Phenol, ethyl-, P 19084², 21604².
- Xylenol, 21604², 54114².
- $C_8H_9O_2$ 2-Butanone, 4-(2 - furyl)-, 54724².
- Methone, 38744².
- $C_8H_9O_2S$ Phenyl mercaptan, 3, 4 - dimethoxy -, 34674².
- $C_8H_9O_2S_2$ Benzene, bis(methylsulfinyl)-, and $HgCl_2$ compd., 4202444².
- $C_8H_9O_3$ 1, 2, 4 - Benzenetriol, 3, 6 - dimethyl -, 44774², 44784².
- Cyclopentaneacetic acid, 1 - carboxy -, anhydride, 1104².
- Isovanillyl alcohol, 44634².
- Malonaldehydic acid, (α -methyl- Δ^2 -butenyldene)-, 44804².
- $C_8H_9O_3S$ *p* - Toluenesulfonic acid, Me ester, 21504², 24834².
- Xylenesulfonic acid, 44124².
- $C_8H_9O_4$ Resorcinol, 2, 5-dimethoxy-, 21814².
- $C_8H_9O_3S$ Xylenesulfonic acid, hydroxy-, 17384².
- $C_8H_9O_4$ Bicyclo[2. 2. 1] - 7 - oxasheptane - 2, 3 - dicarboxylic acid, 16474².
- $C_8H_9O_3S_2$ Xylenedisulfonic acid, 16284².
- $C_8H_9S_2$ Sulfide, methyl *p*-tolyl, 18964².
- $C_8H_9S_2$ Benzene, *m* - bis(methylmercapto)-, $HgCl_2$ compd., 42024².
- $C_8H_{11}AsN_2O$ Arsanilic acid, *N* - (carbamylmethyl)-, 1191².
- Arsanilic acid, *N* - methylcarbamyl-, 54714².
- $C_8H_{11}AsN_2O_2$ Benzenearsonic acid, acetamidaminohydroxy-, 1194².
- $C_8H_{11}AsN_2O_2$ Benzenearsonic acid, 3 - amino - 3-hydroxy-4- α -hydroxyacetamido-, 8424².
- $C_8H_{11}BrN_2$ *o* - Phenylenediamine, 4 - bromo - *N*¹, *N*¹ - dimethyl -, 1174².
- $C_8H_{11}ClN_2$ Phenylenediamine, chlorodimethyl-, 11774².
- $C_8H_{11}ClO \Delta^1 \alpha$ - Cyclopentaneacetyl chloride, α -methyl-, 1104².
- $C_8H_{11}Cl_2O_6$ (See also *Chloralose*)
- β -Glucochloralose, 13914².
- $C_8H_{11}CoN_2O_2$ sec - Methoxoniumhexacyanocobaltate, 4193².
- $C_8H_{11}N$ (See also *Aniline*, *N, N*-dimethyl-, *Aniline*, ethyl-, *Phenethylamine*; *Xyldine*.)
- Benzylamine, α - methyl -, and -HCl, 34514².
- $C_8H_{11}NO$ (See also *Phenetidine*.)
- Anisidine, methyl-, 24304².
- Benzyl alcohol, aminomethyl-, P 14164², 39814²; sulfate, 2394², 30514², 47754².
- Ethanol, 2-hydroxyanilino-, P 32334².
- Ketone, propyl pyrrol, 39794².
- 2 - Pyridineethanol, α -methyl-, 11324².
- Tyramine, 11604², 14404².
- Xylenol, amino-, 1164², 11224².
- $C_8H_{11}NO_2$ Aniline, dimethoxy-, 14014², 51744².
- Creosol, α -amino-, 34524².
- Ethanol, hydroxyanilino-, P 11434², P 14204², P 24484², P 29874², P 42324².
- 2, 6 - Pyridinediol, 3 - isopropyl -, and -HCl, 36684².
- 3 - Pyrrolepropionic acid, 4 - methyl -, 11324².
- Xeronimide, 21844².
- $C_8H_{11}NO_3S$ Methanesulfonanilide, *N*-methyl-, 24274².
- Methanesulfonothiolide, 24274².
- Phenyl mercaptan, 2 - amino - 4, 5 - dimethoxy-, 34674².
- $C_8H_{11}NO_2$ Crotonic acid, α - cyano - β - ethoxy -, Me ester, 44484².
- Isocrotonic acid, α - cyano - β - ethoxy -, Me ester, 44484².
- Phenol, 3 - amino - 2, 6 - dimethoxy -, -HCl, 14054².
- $C_8H_{11}NO_3S$ Methanesulfonanilide, 24274².
- $C_8H_{11}N_2NaO_2$ Sodium barbital, 6674².
- $C_8H_{11}N_2O$ Semicarbazide, 1-tolyl-, 14094².
- Urea, α -ethyl- β -2-pyridyl-, 32274².
- $C_8H_{11}N_2O_2$ Semicarbazide, 1-*p*-anisyl-, 46794².
- $C_8H_{11}N_2S_2$ Thiazole, 2 - (β - allylthiocarbamido) - 4-methyl-, 21774².
- C_8H_{12} Cyclohexadiene, 1, 3-dimethyl -, 28484².
- Norcamphane, 2-methylene-, 36924².
- $C_8H_{12}Ag_2W_2O_8$, 15871².
- $C_8H_{12}Ag_2N_2S_2$, 15871².
- $C_8N_7As_2NO_2$ Arsanilic acid, *N, N* - dimethyl -, P 32344².
- $C_8H_{12}As_2NO_4$ (See also *Etharsanol*.)
- Arsanilic acid, *N* - (β - hydroxyethyl) -, 1194².
- $C_8H_{12}Br_2$ 1, 5 - Hexadiene, 2, 5 - bis(bromomethyl)-, 49284².
- $C_8H_{12}Br_4$ Hexane, 1, 2, 5, 6 - tetrabromo - 2, 5 - bis(bromomethyl)-, 49284².
- $C_8H_{12}ClNO$ Norcamphane, 2 - methylene -, nitrosochloride, 36924².
- $C_8H_{12}Cl_2N_2O_2$ 1, 3 - Dioxol - 4(5) - one, 5 - (dimethylaminomethyl) - 5 - methyl - 2 - (trichloromethyl)-, and -HCl, 3744².
- $C_8H_{12}Cl_4O_2$ *p* - Dioxane, 2, 2, 5, 5 - tetrachloromethyl-, 49274².
- $C_8H_{12}IN$ 1 - Propylpyridinium iodide, 19024².
- $C_8H_{12}NO_3Sb$ Benzenestibonic acid, *p* - β - hydroxyethylamino-, 5984².
- $C_8H_{12}N_2$ Glutaronitrile, α - ethyl - β - methyl -, 47024².
- Indazole, 4, 5, 6, 7 - tetrahydro - 2 - methyl -, 29714².
- Isoindazole, 4, 5, 6, 7 - tetrahydro methyl-, 29714².

- Phenethylamine, *m* - amino-, di - HCl, 5186².
- C₈H₁₁N₃O₂** Pyrimidine, 2,4 - diethoxy -, 3930².
Spiro[cyclopentane - 1,3' - pyrrolidine] - 5' - one, 1' - nitroso -, 819².
Xeronimide, monoxime, 2184⁴.
- C₈H₁₁N₂O₂** (See also *Barbital*.)
Pyrrolizinecarboxylic acid, acetylmethyl -, Me ester, 3704², 5.
- C₈H₁₁N₂O₄** Barbituric acid, 5 - ethyl - 5 - (methoxymethyl)-, 4744².
1 - Hydantoinacetic acid, 3 - methyl -, Et ester, 3443².
3,4 - Isopyrazolodicarboxylic acid, (3,5 - dihydro - 3 - methyl -, di - Me ester, 3704².
Pyrrolizinedicarboxylic acid, methyl -, di - Me ester, 3704², 3705¹.
- C₈H₁₁N₂S** Carbohydrazide, α - methyl - α - phenylthio-, 140⁴.
Carbohydrazide, thio - α - *m* - tolyl -, 140².
- C₈H₁₁O** Cyclohexanone, 2 - ethylidene -, P 3477².
 Δ^2 -Cyclohexenealdehyde, methyl-, 3692².
2-Norcamphanealdehyde, 3692¹.
2 - Propanone, 1 - Δ^1 - cyclopentenyl -, 2946².
—, 1-cyclopentylidene-, 2946².
- C₈H₁₂O₂** Acid, *m*. 68°, from crotonic acid and butadiene, 3692².
Aldehyde, b_p 72-4°, from AcH, 2984².
1,3 - Cyclohexanedione, 5,5 - dimethyl-, 1894², 2715², 3907².
 Δ^2 - Cyclohexenone, 3 - hydroxy - 5,5 - dimethyl-, 1403².
 Δ^1 , α - Cyclopentanecarboxylic acid, α - methyl-, 110².
 β -Pentenic acid, γ - hydroxy - α , α , β - trimethyl-, γ -lactone, 111².
1,2 - Pyrane, 3,4 - dihydro - 4,4,6 - trimethyl-, 2153¹.
- C₈H₁₂O₄** Cyclohexanedicarboxylic acid, P 2986²; and di-*N*-*Na* salt, 487¹².
1,2 - Cyclopropanedicarboxylic acid, 1 - methyl-, di-Me ester, 3704².
Glutaconic acid, β -isopropyl-, 3668².
Glutaric acid, γ - hydroxy - α , α , β - trimethyl-, γ - lactone, 111².
Norpinic acid, 100², 3398², 4686⁴.
- C₈H₁₂O₂** Ethylene oxide α , α - dicarboxylic acid, di-Et ester, 2442².
Glutaric acid, α -keto- β , β , γ -trimethyl-, 111².
- C₈H₁₂O₄** 1,1,2-Ethanetriol, triacetate, 3902².
- C₈H₁₂Br** 2,4 - Hexadiene, 1 - bromo - 2,5 - dimethyl-, 2696⁴.
- C₈H₁₂BrN₂O₂** Glycine, *N* - [*N* - (α - bromobutyryl)glycyl]-, 2993¹.
- C₈H₁₂BrO₂** Isovaleric acid, α -bromo-, allyl ester, 1109⁴.
- C₈H₁₂BrO₂S** 1 - Octenesulfonic acid, bromo - 3 - hydroxy-, sultone, 5467².
- C₈H₁₂ClN₂O₂** Butyric acid, α -(*N*-chloroacetyl-glycyl)amino-, 2993².
- C₈H₁₂ClO₂** 3,3' - Bi[trimethylene oxide] - 3 - carbinol, 3' - (chloromethyl)-, 4927⁴.
- C₈H₁₂ClO₂** Malonic acid, chloro(hydroxymethyl)-(?), di-Et ester, 2442².
Malonic acid, (chloromethyl)hydroxy - (?), di-Et ester, 2442².
- C₈H₁₂ClN₂O₂** 2,5 - Piperazinedione, 1,4 - dimethyl-, compd. with chloral hydrate, 141².
- C₈H₁₂ClN₂O₂P** 1 - Propanol, 3 - chloro - 2 - (chloromethyl) - 2 - nitro -, diester of H₃PO₄, 4927⁴.
- C₈H₁₂I** Norcamphane, 2 - (iodomethyl) -, 3692².
- C₈H₁₂IN₂O** 3,4 - Dihydro - 3 - keto - 1,3,4,5 - tetramethyl - 1 - pyrazinium iodide, 602².
- C₈H₁₂NO** (See also *Tropinone*.)
2(3) - Pyrrolone, 1 - methyl - 5 - propyl -, 4469⁴.
Spiro[cyclopentane - 1,3' - pyrrolidine] - 5' - one, and HgCl₂ compd., 819².
Tropinone, 904⁷.
- C₈H₁₂NO₂** Arecoline, 1178², 1440⁴, 4973², 5545².
- C₈H₁₂NO₂** Malic acid, di - Et ester, nitrate, 1620⁴.
- C₈H₁₂** Butadiene, tetramethyl-, 2696².
Cyclopropane, (α -ethylpropenyl)-, 4935².
Heptadiene, (methyl-, 4197², 4668².
1-Octene, 3898².
- C₈H₁₂ClN** Tropene, 3 - chloro-, and salts, 2183², 7.
- C₈H₁₂ClNO** Tropene, 3 - chloro-, *N* - oxide, and -HCl, 2183².
- C₈H₁₂ClNO₂** 1-Octene, 1-chloro-1-nitro-, 372².
- C₈H₁₂ClNO₂** Butyric acid, β - (β - chlorobutyryl-amino)-, 1389².
Leucine, *N*-chloroacetyl-, 2994².
- C₈H₁₂Cl₂O** Cyclohexane, 1,3 - bis(chloromethoxy)-, 4677².
Isovaleric acid, β , β' - dichloroisopropyl ester, 3913⁴.
- C₈H₁₂N₂** Pyrazole, ethyltrimethyl-, 4700²; and -HCl, 4700².
- C₈H₁₂N₂O₂** Piperazinedione, isobutyl-, 38².
- C₈H₁₂N₂O₂** Glycine, α - methyl - *N*, *N'* - carbonylbis-, di-Me ester, 1618⁴.
- C₈H₁₂N₂O₂S** See *Glutathione*.
- C₈H₁₂O** Δ^2 -Butenyl ether, 2695².
Cycloheptanone, 2-methyl-, 2702².
Cyclohexanecetaldehyde, 5168².
Cyclohexanealdehyde, 2-methyl-, 3692².
Cyclopentanone, 2-ethyl-5-methyl-, 2702².
Ether, bis(α -methylallyl)-, 2695².
Ether, Δ^2 -butenyl α -methylallyl-, 2695².
Heptenone, methyl-, 96², 1745², 4187², 4197⁴.
 Δ^2 , 4 - 1 - Hexadienol, 2,5 - dimethyl -, 2696⁴.
 α - Hexenaldehyde, β , δ - dimethyl-, 1615⁴.
Hexenone, dimethyl-, 96², 2.
- Hydroxobaldehyde**, β , δ - dimethyl-, 1615².
2-Norcamphanecarbinol, 3692².
 α -Pentaldehyde, β , γ , γ -trimethyl-, 1614².
1 - Pentin - 3'-ol, 3,4,4 - trimethyl-, 4673².
- C₈H₁₂O₂** Caproic acid, δ - hydroxy - β , β - dimethyl-, lactone, 2153².
Cyclohexanecarboxylic acid, P 2986².
Cyclohexanecarboxylic acid, methyl-, 3692², 4454².
Octonaphtheneic acid, 1390⁷.
 β - Pentic acid, α , α , β - trimethyl-, and *Ac* salt, 110².
- C₈H₁₂O₂** Caproic acid, δ - keto - β , β - dimethyl -, and *Ag* salt, 2152², 2153².
Caprylic acid, keto-, 2702², 4469².
Cyclohexanecarboxylic acid, 2 - hydroxy - Me ester, P 154², P 2986².
Levulinic acid, trimethyl-, 110².
Octonaphtheneic acid, α -hydroxy-, 1390².
- C₈H₁₂O₂S** Octenesulfonic acid, 3 - hydroxy -, sultone, 5467².
- C₈H₁₂O₂** 3,3' - Bi[trimethylene oxide] - 3,3' dicarbinol, 4927⁴.
2 - *m* - Dioxanethanol, acetate, 4929⁴.
1,1 - Ethanediol, dipropionate, P 608¹.

- Glutaric acid, α, β, γ - trimethyl -, 1878².
 Malonic acid, ethylpropyl-, and di-Na salt, 4871².
 —, methyl-, di-Et ester, 4447².
 Suberic acid, 3138².
C₈H₁₁O₃ δ - Arabonolactone, d_3 - 2,3,4 - trimethyl-, 4451².
 Diethylene glycol, diacetate, 818².
 Lyxonolactone, trimethyl-, 1881², 2423².
 Xylonolactone, trimethyl-, 2423².
C₈H₁₁O₄ Tartaric acid, di-Et ester, 4186², 4448², 5163².
C₈H₁₁Br Heptene, bromomethyl-, 4187², 4638².
C₈H₁₁BrN₂O₂ Isocaproamide, α - (α - bromoacetamido)-, 4232².
 Urea, (α - bromo - α - ethylisovaleryl) -, 4194².
C₈H₁₁BrO₂ Caprylic acid, η - bromo -, 3663².
 Isovaleric acid, α - bromo -, Pr and isopropyl esters, 1109².
C₈H₁₁BrO₃S 1 - Octanesulfonic acid, bromo - 3 - hydroxy-, sultone, 5467².
C₈H₁₁Cl Heptene, chloromethyl-, 4187², 4197².
C₈H₁₁ClCoN₂O₄, 3417².
C₈H₁₁ClN₂O₂ Malonamide, α - amyl - α - chloro -, P 3480¹.
C₈H₁₁ClO₃S 1-Octanesulfonic acid, chloro - 3 - hydroxy-, sultone, 5467².
C₈H₁₁HgN Heptane, 1-(cyanomercuri)-, 1871².
C₈H₁₁N (See also *Cicutine*.)
 Butyronitrile, α, α -diethyl-, P 2987².
 Compd. from sparteine, salts, 5188².
p-Indole, octahydro-, 2714².
C₈H₁₁NO₂ (See also *Hygrine*; *Pelletierine*, *Pseudotropanol*; *Tropanol*; *Tropine*.)
 Crotonamide, *N*, *N*-diethyl-, 2697².
 Cycloheptanone, 2-methyl-, oxime, 2702².
 Granataninol, 3018².
 Isopelletierine, 1132².
 α -Pentaldehyde, β, γ, γ -trimethyl-, oxime, 1614².
 4-Piperidone, 1-propyl-, -HCl, 1902².
 —, 2,2,6-trimethyl-, 2935¹.
 2 - Pyrrolidone, 4,4 - diethyl -, and HgCl₂ compd., 819².
C₈H₁₁NO₂ (See also *Arecoline*; *Isatin*.)
 1-Octene, 1-nitro-, 372².
C₈H₁₁NO₄ Aspartic acid, di-Et ester, 1620².
C₈H₁₁NO₅ *d*-Glucose, 1-amino-, monoacetate, 1626¹.
C₈H₁₁N₂O Δ^1 - 2 - Pentenone, 3,4 - dimethyl-, semicarbazone, 110².
C₈H₁₁N₂O₂ Butyric acid, α - (*N* - glycylglycyl) - amino-, 2993².
 Glycine, *N* - [*N* - (α - aminobutyl)glycyl] -, 2993¹.
C₈H₁₁N₂ Biguanide, diallyl-, salts, 4931².
C₈H₁₁ Cyclohexane, dimethyl-, 3897², 4559², 5411².
 Heptene, methyl-, 2848¹, 4668².
 Octene, 1384², 3897².
 Pentene, trimethyl-, 2561².
C₈H₁₁AsCl₂N Arsine, dichloro(-) - 1 - piperidyl propyl-, -HCl, 92².
C₈H₁₁Br₂ Heptane, dibromo - 2 - methyl -, 4668².
C₈H₁₁Br₂NiO₄, 3417².
C₈H₁₁Br₂Se Selenophene, 2,3,4,5 - tetrahydro -, δ - bromobutyl bromide addn. compd., 3704².
C₈H₁₁ClN Cyclohexylamine, 4 - (β - chloroethyl)-, and chloroplatinate, 2715².
C₈H₁₁ClNO 2 - Octanol, 1 - chloro - 1 - nitro -, 3702².
C₈H₁₁Cl₂CoN₂O₄ + 2H₂O, 3417².
C₈H₁₁Cl₂PtSe₂ Selenophene, 2,3,4,5 - tetrahydro -, chloroplatinate chloride, 3704².
C₈H₁₁HgO₂ Hexane, 1 - (acetoxymethyl) -, 1871².
C₈H₁₁N₂NiO₄, 3417².
C₈H₁₁N₂O 1- Piperazinebutyric acid, and chloroplatinate, 2183².
C₈H₁₁N₂O₂ Butyric acid, aminobutylamino-, 1389², 2730².
 Glycine, leucyl-, 389², 1144², 5477².
 Leucine, glycyl-, 389², 1144², 1429¹.
C₈H₁₁N₂O₃ Carbamic acid, thiono - *N*, *N'* - ethylenebis-, 2953².
C₈H₁₁N₂O₄ Glutaramide, α, β, γ - trimethoxy -, 1881².
C₈H₁₁N₂S₂ Disulfide. bis(ethylmethylthiocarbamyl), 1307².
C₈H₁₁O 2 - Heptanone, 6 methyl -, 1614², 3702².
 Heptenol, methyl-, 4187², 4668².
 3-Hexanone, 4,4-dimethyl-, 1615².
 2-Octanone, 1872².
 Pyran, tetrahydro - 2,2,6 - trimethyl -, 4187².
C₈H₁₁O₂ Butyric acid, α, α -diethyl-, 1108².
 Butyric acid, α, α -dimethyl-, Et ester, 3438².
 Caproic acid, Et ester, 4440².
 Caprylic acid, 1549¹, 3143², 4265², 4469².
m - Dioxane, 5 - ethyl - 2,5 - dimethyl -, 1615².
 —, 2 - isopropyl - 4 - methyl -, 1615².
 Δ^1 - 2,5 - Hexenediol, 2,5 - dimethyl -, 1109².
 3-Octanone, 5-hydroxy-, P 3477².
 2 - Pentanone, 3 - hydroxy - 3,4,4 - trimethyl-, 4673².
C₈H₁₁O₂ Caprylic acid, η -hydroxy-, 3663².
 2 - *m* - Dioxanecethanol, $\alpha, 4$ - dimethyl -, 4930¹.
 Valeric acid, α - hydroxy -, α - methyl -, Et ester, 4673².
 —, α -hydroxy- α -propyl-, 4673².
C₈H₁₁O₃S 1 - Octanesulfonic acid, 3 - hydroxy -, sultone, 5467².
C₈H₁₁O₄ Arabofuranose, 2,3,5 - trimethyl -, 2423².
 Glycolaldehyde, Me carbonate, di - Et acetal, 3902².
 Lyxose, trimethyl-, 1881².
 Xylose, trimethyl-, 4450².
 Xyloside, 2,3 - dimethylmethyl-, 5168².
C₈H₁₁O₅ Monomethyl deriv., m. 204.5°, of glyceralddehyde, dimer, 4446¹.
C₈H₁₁Br See *Octane, bromo-*.
C₈H₁₁BrMg Octylmagnesium bromide, 2934².
C₈H₁₁BrO₃S 1 - Octanesulfonic acid, bromo - 3 - hydroxy-, 5467².
C₈H₁₁Br₂N Dibutylamine, β, β' - dibromo -, -HBr, 4669².
C₈H₁₁Cl Octane, 2-chloro-, 5157².
C₈H₁₁Cl₂N Dibutylamine, β, β' - dichloro -, 4669².
C₈H₁₁I Octane, 2-iodo-, 5157².
C₈H₁₁IN₄ Hexamethylenetetramine, ethiodide 1871².
C₈H₁₁N Δ^1 - Butenylamine, α - meth. - *N* propyl-, P 3052².
 Conine, 909², 2534², 5271².
 Cyclohexylamine, 2,5-dimethyl-, P 846².
 Pilocarpine, ethyl-, P 2190²; and -HCl, 13¹.
 Piperidine, 3-ethyl-4-methyl-, 4702².
 —, 2,2,6 - trimethyl-, and salts, 92².
C₈H₁₁NO Butyramide, *N*, *N*-diethyl-, 3208².

- Caproamide, α, α -dimethyl-, 125⁴.
 Conhydrine, 1132¹.
 Cyclohexanethanol, 4 - amino-, 2715⁴.
 Ethanol, cyclohexylamino-, 248⁴.
 2 - Piperidineethanol, 1-methyl-, 1902³.
 C₂H₁₇NO: Isovaleric acid, β -methylamino-,
 Et ester, 3207⁴.
 Leucine, Et ester, 1617⁴.
 C₂H₁₇NO₂: Isobutyric acid, β - dimethylamino -
 α - hydroxy -, Et ester, 374³.
 C₂H₁₇N₂O₂: Biuret, 1,1 - dipropyl-, 3442⁴.
 Isocaproamide, α - glycylamino -, - HBr,
 4232².
 C₂H₁₇N₂O₂: 2 - Pentanone, 1,5 - dimethoxy -,
 semicarbazone, 3900².
 C₂H₁₇N₂: Biguanide, α - (α - methyl - Δ^4 - , pen-
 tenyl) -, - H₂SO₄, 4931².
 C₂H₁₁: (See also *Octane*.)
 Butane, 2,2,3,3 - tetramethyl -, 1054⁷.
 Heptane, 3 - methyl -, 3897⁴.
 Hexane, dimethyl-, 1386⁴, 3897⁴.
 —, 3-ethyl-, 3897⁴.
 Pentane, 3-isopropyl-, 3897⁴.
 —, trimethyl-, 30⁴, 90⁴, 1054⁷, 3897⁴.
 C₂H₁₇AsNO₂: 1 - Propanearsonic acid, 3 - (1 -
 piperidyl) -, - HCl, 92².
 C₂H₁₇BrN 1,1 - Diethylpyrrolidinium bromide,
 3022².
 Hexamethylenimine, 1 - methyl -, metho-
 bromide, 3022².
 C₂H₁₇ClCoN₂S₂, 2900².
 C₂H₁₇ClNO Triethylamine, β - (β - chloro-
 ethoxy) -, P 241¹.
 C₂H₁₇ClNS Triethylamine, β - (β - chloroethyl-
 mercapto) -, P 241¹.
 C₂H₁₇CoN₂O₂S₂ + H₂O, 2900².
 C₂H₁₇Hg Mercury dibutyl, 1870⁴, 2955¹.
 Mercury diisobutyl, 816².
 C₂H₁₇Hg₂O₂S Butane, 1 - (hydroxymercuri) -,
 sulfate, 1871².
 C₂H₁₇N₂O₂, 2,3 - Butanediamine, succinate,
 3663¹.
 C₂H₁₇N₂O₂: Propionaldehyde, β - ethylamino -,
 semicarbazone, acetate, 3209².
 C₂H₁₇O 1 - Hexanol, dimethyl -, 125⁴, 2696⁴.
 Octanol, P 3933², 5157⁴.
 Octyl alcohol, 3143⁴, 4142⁷, 5074².
 C₂H₁₇O₂, 2,6 - Heptanediol, 2 - methyl -,
 4187⁴.
 3,4 - Hexanediol, 3,4 - dimethyl -, 1615⁴.
 C₂H₁₇O₂: Orthoacetic acid, tri-Et ester, 2639².
 C₂H₁₇O₂S: See *Trional*.
 C₂H₁₇S Butyl sulfide, HgCl₂ compd., 3565²,
 4925².
 Compd. from cracked naphtha sludge, and
 HgCl₂ compds., 3565².
 Isobutyl sulfide, HgCl₂ compds., 3565²,
 4925².
 C₂H₁₇Zn, Zinc butyl, 1386².
 C₂H₁₇ClN₂O Trimethyl(propylcarbamy)methyl)-
 ammonium chloride, 3023¹.
 C₂H₁₇S Hexyldimethylsulfonium iodide, 4669².
 C₂H₁₇N Hexylamine, β, β - dimethyl -, and
 chloroplatinate, 125⁴.
 C₂H₁₇NO₂: 1 - Propanol, 3 - diethylamino - 2 -
 methoxy -, P 2234¹.
 Propionaldehyde, β -propylamino-, dimethyl
 acetal, 3209².
 C₂H₁₇N: Guanidine, isocamyl - α, α - dimethyl -,
 P 5194².
 C₂H₁₇AsI₂: Dimethyldipropylarsonium triiodide,
 120².
 C₂H₁₇As₂O Arsenic, diethyl-, oxide, 1614⁴.
 C₂H₁₇ClN Tetraethylammonium chloride, 3617².
 C₂H₁₇ClNO₄ Tetraethylammonium perchlorate,
 3617².
 C₂H₁₇IN Tetraethylammonium iodide, 3390²,
 3617².
 C₂H₁₇IO₃ Ethyltellurium oxyiodide, 2113⁷.
 C₂H₁₇NO₃P Tetraethylphosphonium nitrate,
 1868².
 C₂H₁₇N₂: 1,3 - Butanediamine, N¹, N¹, N², 2 -
 tetramethyl -, P 1416⁴.
 Cadaverine, 2 - ethyl - 3 - methyl -, 4702².
 Putrescine, tetramethyl-, 472².
 C₂H₁₇N₂: Guanidine, N, N' - ethylenebis[ethyl -,
 P 1649⁴.
 Guanidine, α, α' - hexamethylenebis -, sul-
 fate, P 1649⁴.
 C₂H₁₇N₂S: Guanidine, α, α' - pentamethylene-
 bis-, trithiocarbonate, 1881².
 C₂H₁₇N₂S: Hexamethylenetetramine, compd.
 with thiourea, 5185⁴.
 C₂H₁₇OS Hexyldimethylsulfonium hydroxide,
 4669².
 C₂H₁₇O₂Si Ethyl orthosilicate, 93².
 C₂H₁₇Pb See *Plumbane*, tetraethyl-.
 C₂H₁₇Si, Silicane, tetraethyl-, 3661⁷.
 C₂H₁₇Sn Stannane, tetraethyl-, 5362².
 C₂H₁₇NO Amyltrimethylammonium hydroxide,
 2419².
 Tetraethylammonium hydroxide, 2092².
 C₂H₁₇BeI₂O₄, 783².
 C₂H₁₇Cl₂CrO₄, 4904³.
 C₂H₁₇Cl₂MoN₂O, 2899⁷.
 C₂H₁₇N₂O Tetramethylammonium hydroxide,
 4905².
 C₂H₁₇BrLiN Addn. compd. from LiBr and
 Me₂NH, 2118².
 C₂H₁₇AgIN₂S₂, 5429¹.
 C₂H₁₇MoN₂ + 2H₂O Potassium octaryanomolyb-
 date, 574².
 C₂Mo₂O₂, 4419⁴.
 C₂H₁₇BrClO Indone, 2 - bromo - 3 - chloro -,
 829¹.
 C₂H₁₇Br₂N₂O Quinoline, 3,5 - dibromo - 8 -
 nitro-, 3229¹.
 C₂H₁₇Br₂N₂O Cinnamic acid, 3,4,5 - tribromo -
 2-nitro-, 1890².
 C₂H₁₇ClN₂O Quinoline, 8 - chloro - 5,7 - di-
 nitro-, 3229¹.
 C₂H₁₇Cl₂O₂S 3,4 - Thiochromandione, 2,2 -
 dichloro -, 2440².
 C₂H₁₇Cl₂O₂S 3,6 - Coumarindisulfonyl chloride,
 127¹.
 C₂H₁₇BrClNO Indone, bromochloro-, oxime,
 829¹.
 C₂H₁₇Br₂N₂O Quinoline, bromonitro-, 3229¹.
 C₂H₁₇Br₂O Cinnamic acid, 3,4,5 - tribromo -,
 1890².
 C₂H₁₇ClO Chromone, 2-chlorohydroxy-, 2441¹.
 C₂H₁₇ClO₂S 6 - Coumarinsulfonyl chloride,
 126¹.
 C₂H₁₇Cl₂N₂O Benzaldehyde, 3,4,5 - trichloro -
 2 - nitro -, semioxamazone, 1891⁴.
 C₂H₁₇Cl₂O 1 - Indanone, 4,5,7 - trichloro -,
 126¹.
 C₂H₁₇FeNO Pyridine, compd. with Fe(CO)₅,
 837¹.
 C₂H₁₇NO Propiolic acid, (o - nitrophenyl) -,
 1639², 3690².
 C₂H₁₇NO Umbelliferone, 8 - nitro-, 3219².
 C₂H₁₇NO₂S 3 - Coumarinsulfonic acid, 6 -
 nitro-(?), and Na salt, 126¹, 137¹.
 C₂H₁₇NO₂S 8 - Quinoline dianhydrate, 5,7 -
 dinitro-, 3229².
 C₂H₁₇BrClO Cinnamic acid, α - bromo - β -
 chloro -, 829¹.

- C₈H₇BrClO₂** Hydrocinnamic acid, α - bromo - α , β , β - trichloro -, 829².
C₈H₇BrN Isoquinoline, bromo -, and -HNO₂, 1642².
 Quinoline, bromo-, 3228², 3229¹.
C₈H₇ClHgN Isoquinoline, (chloromercuri) -, 1642².
C₈H₇ClN Cinnamonitrile, α - chloro -, 2166⁴.
C₈H₇ClNO₂ Benzazete, 1 - acetyl - 5 - chloro - 1,2 - dihydro - 2 - keto -, 828².
 Isatin, chloromethyl-, P 2725⁸.
 5(4) - Isoxazolone, 3 - (chlorophenyl), 3218².
C₈H₇Cl₂O, 1 - Indanone, dichloro-, 126⁴.
C₈H₇Cl₂N 2,5 - Xylonitrile, 3,4,6 - trichloro -, 3674².
C₈H₇Cl₂N₂O₂ Benzaldehyde, 3,4,5 - trichloro -, semioxamazone, 1891⁴.
C₈H₇Cl₂N₂ Acetyl chloride, dichloro-, azine with BzCl, 836².
C₈H₇Cl₃O Hydrocinnamyl chloride, 2,3,5 - trichloro-, 126⁴.
C₈H₇Cl₃O₂ Hydrocinnamic acid, α , α , β , β - tetrachloro-, 829².
C₈H₇INO₂S See *Yatren*.
C₈H₇N₂O₂ Propiolamide, (o - nitrophenyl)-, 5163².
C₈H₇N₂O₂S 3 - Coumarinsulfonamide, 6 - nitro -, 127².
C₈H₇N₂O₂ 8 - Quinoline diazohydrate, 5 - nitro -, 3228².
C₈H₇N₂O₂ Quinoline, aminodinitro-, 1904¹, 3228¹.
C₈H₇N₂ Malononitrile, trimer, 1114⁴.
C₈H₇O₂ (See also *Coumarine*.)
 Propiolic acid, phenyl-, 828².
C₈H₇O₂ 2,1 - Benzopyran - 1,3(4) - dione, 599².
 Umbelliferone, 3639².
C₈H₇O₂S Thiochromone, 2,3 - dihydroxy -, 2440^{1,2}.
C₈H₇O₂S 6 - Coumarinsulfonic acid, and *Na salt*, 126^{2,2}.
C₈H₇O₂S 3,6 - Coumarindisulfonic acid (?), and *Na salt*, 126², 127¹.
C₈H₇BrN₂O₂ 1,2,3,6 - Dioxdiazine, 4 - (p - bromophenyl) - 5 - methyl -, 1788².
 Furozan, 4 - (p - bromophenyl) - 3 - methyl -, 1788².
C₈H₇BrO 1 - Indanone, 4 - bromo -, 126⁴.
C₈H₇BrO Acrylophenone, p - bromo - β - hydroxy-, 827¹.
C₈H₇Br₂N₂O Ether, β , γ - dibromopropyl picryl, 3450¹.
C₈H₇Br₂O Ether, allyl 2,4,6 - tribromophenyl, 3450¹.
C₈H₇Br₂O Ether, β , γ - dibromopropyl 2,4,6 - tribromophenyl, 3450¹.
C₈H₇ClN Quinoline, aminochloro-, 1903⁴.
C₈H₇ClN₂O₂ Anthranilic acid, 4 - chloro - N - (cyanomethyl) -, 828².
C₈H₇ClO 1 - Indanone, chloro -, 126⁴, P 606⁴, P 1416¹.
C₈H₇ClO Acrylophenone, p - chloro - β - hydroxy-, 827¹.
 1 - Indanone, 4 - chloro - 7 - hydroxy -, 126⁴.
C₈H₇ClO₂S Benzoic acid, 3 - (carboxymethylmercapto) - 4 - chloro -, P 3478⁴.
C₈H₇Cl₂NO₂ 3 - p - Toluquinonimine, N - acetyl - 2,6 - dichloro -, 1888¹.
C₈H₇Cl₂O Hydrocinnamyl chloride, dichloro-, 126⁴.
C₈H₇Cl₂O₂ Hydrocinnamic acid, 2,3,5 - trichloro-, 126⁴.
C₈H₇Cl₂NO₂ Anisole, 4 - nitro - 2 - (α , α , β - tetrachloroethyl) -, 599⁴.
C₈H₇N See *Isoquinoline*; *quinoline*.
C₈H₇NO Sulfate—(see also *Quinisol*).
 Quinolol, 1588¹, 1589¹, P 3931⁴.
C₈H₇NO₂ Cinnamic acid, α - amino - β - hydroxy-, lactone, 3914⁵.
 Isatin, methyl-, P 2725⁸.
 2,3 - Quinolinediol, 2442².
 Spiro[ethylene oxide - α ,3' - oxindole], 2441².
C₈H₇NO₂S Acetic acid, thiocyno-, Ph ester, 4930².
C₈H₇N₂O₂S Thiazole, 4 - (3,4 - dihydroxyphenyl) - 2 - mercapto -, 3470².
C₈H₇N₂O₂ 3,4 - Chromandione, monoxime, 2411².
C₈H₇NO₂ Acrylophenone, β - hydroxy - m -nitro-, 827².
 Styrene, 3,4 - methylenedioxy - β - nitro -, 3214².
C₈H₇NO₂S 6 - Coumarinsulfonamide, 127¹.
C₈H₇N₂NaO₂ Compd. from malonic acid and o -phenylenediamine, Na deriv., 141⁴.
C₈H₇N₂O 8 - Quinoline diazohydrate, 3228².
C₈H₇N₂O₂ Quinoline, aminonitro-, 1903², 3227².
C₈H₇N₂O₂ Benzisoxazole, 2 - acetamido - 5 - nitro-, 2973².
 1,2,4 - Oxadiazole, 5 - methyl - 3 - (4 - nitrosalicyl)-, 3273².
C₈H₈ (See also *Indene*.)
 Benzene, propargyl-, 90².
C₈H₇AgN₂O₂ 2(1) - s - Triazole, tetrahydro - 4 - imino - 6 - (nitrophenyl) -, Ag deriv., 4220¹, 5⁴.
C₈H₇AsNO₂ Quinolinearsonic acid, dihydroketo-, 1686².
C₈H₇AsNO₂ 1,4 - Benzisoxazine - 8 - carboxylic acid, 6 - arsono - 3 - hydroxy -, 841².
C₈H₇BrClO Hydrocinnamyl chloride, 2-bromo-, 126⁴.
C₈H₇BrNS Benzothiazoline, 5 - bromo - 2 - methyl-1-methylene-, 390².
C₈H₇BrN₂O Piperonal, 6-bromo-, semicarbazone, 4204⁴.
C₈H₇Br₂ClNO Ether, 4 - chloro - 2 - nitrophenyl β , γ -dibromopropyl, 3450¹.
C₈H₇Br₂IO₂S 3 - 1,2,3 - Thiodiazoline, 5,5 - dibromo - 4 - methyl - 2 - phenyl - 1 - dioxide, 4188¹.
C₈H₇Br₂N₂O p - Acetaniside, 2,6 - dibromo - 3-nitro-, 3675².
C₈H₇Br₂N₂O Ether, α - (dibromonitromethyl) - p -nitrobenzyl methyl, 116⁴.
C₈H₇Br₂N₂O Ether, allyl 2,4 - dibromophenyl, 3450¹.
 Hydrocinnamyl bromide, α -bromo-, 4463⁴.
C₈H₇Br₂O Guaiacol, 5,6 - dibromo-, acetate, 3675².
C₈H₇Br₂O Ether, 2,4 - dibromophenyl - β , γ - dibromopropyl, 3450¹.
C₈H₇CINO₂S Benzothiazole, 4(?) - chloro - 5 - methoxy-1-methyl-, 390².
C₈H₇CINO₂ Oxindole, 3 - (chloromethyl) - 3 - hydroxy-, 2442².
C₈H₇CINO₂ Anthranilic acid, N - acetyl - 4 - chloro-, 828².
C₈H₇CINO₂S Acetic acid, (2 - carbamyl - 5 - chlorophenylmercapto)-, P 3235⁴, P 3478⁴.
C₈H₇CINO₂ Glycine, N - (2 - carboxy - 5 - chlorophenyl)-, 828².
C₈H₇CINS Benzothiazole, 5 - chloro - 1,3 - dimethyl-, 390².

- Benzothiazoline, chloro - 2 - methyl - 1 - methylene-, 390^a.
- C₈H₈ClN₂O** 4(3) - Quinazolone, 3 - amino - 7 - chloro - 2 - methyl-, 828^a.
- C₈H₈ClN₂O** Piperonal, 6 - chloro-, semicarbazone, 4204^a.
- C₈H₈Cl₂N₂O** Benzaldehyde, 4 - amino - 3,5 - dichloro-, semioxamazone, 1891^a.
- C₈H₈Cl₂O** Hydrocinnamyl chloride, 2 - chloro-, 126^a.
- C₈H₈Cl₂O** Hydrocinnamic acid, dichloro-, 126^a.
- C₈H₈Cl₂O₂** *m* - Benzenedisulfonyl chloride, 2-hydroxy-5-methyl-, acetate, 1630^a.
- C₈H₈N₂** Pyridine, pyrrol-, 1690^{1,2}.
- Quinoline, amino-, 1903^a.
- C₈H₈N₂O** Furazan, 3 - methyl - 4 - phenyl-, 1788^a.
- Oxazole, 2 - amino - 4 - phenyl-, 2177^a.
- 2-Quinoxalinecarbinol, 819^a.
- C₈H₈N₂O₂** Acetanilide, *p*-thiocyano-, 2245¹.
- C₈H₈N₂O₂** 1,2,3,6 - Dioxiazine, 4 - methyl - 5-phenyl-, 1788^a.
- 1,2,3,6 - Dioxiazine, 4 - *p*-tolyl-, 4447^a.
- Furoxan, 3 - methyl - 4 - phenyl-, 1788^a.
- , 3(and 4) - *p*-tolyl-, 4447^a.
- Hydrocinnamonitrile, *p*-nitro-, 1645^a.
- 1,3,4,6 - Oxidiazin - 5(4) - one, 2 - phenyl-, 2977^a.
- p*-Tolyl cyanide, *N*-oxide, oxime, 4447^a.
- C₈H₈N₂O₂S** Thiazole, 2 - amino - 4 - (3,4 - dihydroxyphenyl) -, - *HCl*, 3470^a.
- C₈H₈N₂O₄** Barbituric acid, 5 - (2 - furylmethyl) -, 5472^a.
- Glutaconic acid, α,γ - dicyano -, di - Me ester, 375^a.
- C₈H₈N₂O₄** Benzophydroxamic acid, 2 - hydroxy - 4-nitro-, acetyl deriv., 2974¹.
- C₈H₈N₂O₄** 3,6 - Coumarindisulfonamide, 127¹.
- C₈H₈N₂O₅** Hydrocinnamic acid, 4 - hydroxy - 3,5-dinitro-, 4705^a.
- C₈H₈N₂O₅S** Methionine acid, cyanophenylcarbamyl-, 3205^a.
- C₈H₈N₂O₅** Malonic acid, *N* - (α - carhamyl - α - cyanoacetyl) - α - cyano -, Me ester, 4193^a.
- Piperonal, 6 - nitro -, semicarbazone, 4204^a.
- C₈H₈O** (See also *Cinnamaldehyde*.)
- 1-Indanone, P 606^a, P 813^a.
- C₈H₈O** (See also *Cinnamic acid*.)
- 1,2 - Propanedione, 1 - phenyl -, 3912^a.
- Styrene, methylenedioxy-, 1890^a.
- C₈H₈O** Acetic acid, benzoyl-, 1120^a.
- Phthalide, 4 - methoxy -, 2183^a.
- C₈H₈O** (See also *Acetylsalicylic acid*.)
- Caffeic acid, 1882^a.
- Cresotic acid, formyl-, P 3714^a.
- C₈H₈O₂** Benzoic acid, *o* - (carboxymethyltelluro)-, 2956^a.
- C₈H₈O₂** Phthalic acid, 4 - methoxy-, 2183^a.
- C₈H₈As₂O₂** 8 - Benzoxazolinecaronic acid, 6 - acetamido - 1 - keto -, 842^a.
- C₈H₈Br** Benzene, 1 - allyl - 4 - bromo -, 2157^a, 3908^a.
- Benzene, 1 - bromo - 4 - propenyl -, 2157^a, 3908^a.
- C₈H₈BrClNO₂S** 5 - Bromo - 1,2 - dimethylbenzothiazolium perchlorate, 390^a.
- C₈H₈BrClNS** Chloro - 1,2 - dimethylbenzothiazolium bromide, 390^a.
- C₈H₈BrINS** 5 - Bromo - 1,2 - dimethylbenzothiazolium iodide, 390^a.
- C₈H₈BrN₂O₂S** Δ^1 - 1,2,3 - Thidiazoline, 8 - bromo - 4 - methyl - 2 - phenyl - 1 - dioxide, 4188^a.
- C₈H₈BrO** Ethylene oxide, (*p* - bromobenzyl) -, 2157^a.
- Ethylene oxide, α - (*p* - bromophenyl) - β methyl-, 2157^a.
- C₈H₈BrO₂** Benzoic acid, *o* - bromo -, Et ester, 5182^a.
- Hydrocinnamic acid, 2 - bromo-, 126^a.
- C₈H₈Br₂O** Acetanilide, dibromo-, 3674^a, 3675^a.
- C₈H₈Br₂** Benzene, 1 - bromo - 4 - (dibromopropyl) -, 2157^{a,4}.
- Mesitylene, 2,4,6 - tribromo-, 4937¹.
- C₈H₈Br₂O** Ether, isopropyl 2,4,6 - tribromo phenyl, 3450¹.
- C₈H₈Cl** Cinnamyl chloride, 5211^a.
- Indan, 1 - chloro-, 1130¹.
- C₈H₈ClINS** Chloro - 1,2 - dimethylbenzothiazolium iodide, 390^a.
- C₈H₈ClN₂O₂** Hydrazine, α - benzoyl - β - chloro acetyl-, 2977^a.
- C₈H₈ClO₂** Benzoic acid, *o* - chloro -, Et ester, 5182^a.
- Formic acid, chloro-, phenethyl ester, 124^a.
- Hydrocinnamic acid, 2-chloro-, 126^a.
- α -Toluic acid, α -chloro-, Me ester, 2154^a.
- C₈H₈ClO₂** Acetyl chloride, (*m* - methoxyphenoxy)-, 4481^a.
- Benzoic acid, 5 - chloro - 2 - methoxy -, Me ester, 1128^a.
- C₈H₈Cl₂NO₂** *o* - Acetotoluide, 3,5 - dichloro - hydroxy-, 1888¹.
- Hydrocinnamic acid, 2 - amino - 3,5 - dichloro -, 126^a.
- C₈H₈Cl₂NO₂S** Chloro - 1,2 - dimethylbenzothiazolium perchlorate, 390^a.
- C₈H₈Cl₂N** Acetone, 2,4,6 - trichlorophenyl hydrazone, 4679^a.
- C₈H₈Cl₂O** Anisole, 2,4,5 - trichloro - 3,6 - dimethyl-, 3674^a.
- C₈H₈IO₂** Benzoic acid, 2 - iodo - 3 - methoxy -, Me ester, 129^a.
- C₈H₈INO₂** Tyrosine, diiodo-, 5207^a, 5224^a.
- C₈H₈N** (See also *Skatole*.)
- Indole, methyl-, 1635^a, *derivs.*, 3225^a.
- C₈H₈NO** Hydrocarbostyryl, 125^a.
- Phloretonitrile, 1645¹.
- C₈H₈NO₂S** Benzothiazole, 5 - methoxy - 1 - methyl -, 390^a.
- C₈H₈NO₂** Benzonitrile, 2,6 - dimethoxy-, 3450^a.
- C₈H₈NO₂** Anisole, *m* - (β - nitrovinyl) -, 5177^a.
- Compd., *m*. 98-9^a, from maleic anhydride and 1-methylpyrrole, 3693¹.
- 2- Propanone, 1 - (*p* - nitrophenyl) -, 244^a.
- C₈H₈NO** Benzaldehyde, 5 - ethoxy - 2 - nitro-, 3929^a.
- 1,3 - Dioxolane, 2 - (*p* - nitrophenyl) -, 596^a.
- Phenol, 5 - methoxy - 2 - (β - nitrovinyl) -, 4455^a.
- Salicylic acid, 4495¹.
- C₈H₈NO₂** Syringic acid, nitro-, 1405¹.
- C₈H₈NS** Benzothiazole, 1 - ethyl -, 142^a.
- C₈H₈NS₂** 2(1) - Benzoisothiazolone, 1 - ethyl thio-, 4701^a.
- C₈H₈NS₂O** Benzoselenazoline, 2 - methyl - 1 - methylene-, 142^a.
- C₈H₈N₂** 3 - Triazole, 3 - methyl - 5 - phenyl -, 836^a.
- C₈H₈N₂O** Formanilide, 2 - amino - 4 - (cyano methyl)-, 141^a.
- Furazan, 3 - amino - 4 - *p*-tolyl - 133^a.

- $C_9H_7N_3OS$ Acetic acid, β -*p*-thiocyanophenyl-hydrazide, 2245².
1,3,4-Thiodiazolid-2-one, 5-tolylimino-, 2974⁴.
- $C_9H_7N_3O_2$ 1,2,3,6-Dioxdiazine, 4-amino-5-*p*-tolyl-, 133⁵.
- $C_9H_7N_3O_2$ Glyoxylic acid, phenyl-, semicarbazone, 4685⁵.
- $C_9H_7N_3O_2S$ Δ^3 -1,2,3-Thiodiazoline, 4-methyl-5-nitro-2-phenyl-, 1-dioxide, 4188¹.
- $C_9H_7N_3O_2$ *m*-Acetotoluide, 4,6-dinitro-, 1887⁴.
- $C_9H_7N_3O_2$ *o*-Acetotoluide, 4-hydroxy-3,5-dinitro-, 1888¹.
Carbanilic acid, *N*-methyl-2,4-dinitro-, Me ester, 5171⁴.
- $C_9H_7N_3O_2$ 2(1)-*s*-Triazone, tetrahydro-4-imino-6-(nitrophenyl)-, and salts, 42201.2.3.4.5.6.
- C_9H_{10} Benzene, allyl-, 2703², 3908², 4937².
Benzene, propenyl-, 3908², 4937².
Styrene, α -methyl-, 3213¹.
- $C_9H_{10}AsNO_4$ 1,4-Benzisoxazine-6-arsonic acid, 3-hydroxymethyl-, 841^{5.2}.
- $C_9H_{10}AsNO_4$ *o*-Arsanilic acid, *N*-acetyl-4,5-methylenedioxy-, 3677⁴.
- $C_9H_{10}AsNO_7$ Salicylic acid, 3-acetamido-5-arsono-, 841⁵.
- $C_9H_{10}AsN_3O_4$ 3-Pyridinecarsonic acid, 6-(4,5-dihydro-5-keto-3-methyl-1-pyrazolyl)-, 1641⁷.
- $C_9H_{10}AsN_3O_4$ 4-Benzoxazolecarsonic acid, 6-acetamido-1-amino-, 2429⁶.
- $C_9H_{10}BrNO$ Propionanilide, α -bromo-, 1112⁹.
- $C_9H_{10}BrNO_2$ Compd., m. 92°, from benzocaine and Br, 1892⁹.
- $C_9H_{10}Br_2$ Benzene, (α,β -dibromopropyl)-, 3908².
- $C_9H_{10}Br_2N_2$ Acetone, (dibromophenyl)hydrazone, 1400⁶.
- $C_9H_{10}Br_2N_2S$ Compd. m. 273°, from thio-2,4-xylylurea and bromine, 3705².
- $C_9H_{10}Br_2O$ Ether, 2,4-dibromophenyl isopropyl-, 3450¹.
- $C_9H_{10}Br_2O_2S$ Benzoic acid, *m*-(ethylmercapto)-dibromide, 824⁶.
- $C_9H_{10}Br_2N_2S$ Urea, α -methylthio- β -*o*-tolyl-, bromine deriv., 835².
- $C_9H_{10}ClNO_2$ *o*-Acetotoluide, α -chloro-4-hydroxy-, 1887⁴.
Anthranilic acid, 4-chloro-, Et ester, 828².
Hydrocinnamic acid, aminochloro-, 126¹, and -HCl, 1877¹.
- $C_9H_{10}ClNO_2S$ Acetic acid, (aminochlorotolyl)-mercapto-, P 3354⁴.
- $C_9H_{10}ClNO_2$ Ether, 2-chloro-4-nitrophenyl isopropyl-, 117².
- $C_9H_{10}ClN_2O_2$ Acetone, 2-chloro-4-nitrophenylhydrazone, 4679⁶.
- $C_9H_{10}Cl_2N_2$ Acetone, 2,4-dichlorophenylhydrazone, 4679⁶.
- $C_9H_{10}Cl_2N_2O$ Acetic acid, β -(2,5-dichlorophenyl)- β -methylhydrazide, 4700².
- $C_9H_{10}Cl_3N$ 2,5-Xylidine, 3,4,6-trichloro-*N*-methyl-, 3674⁴.
- $C_9H_{10}CuO_4$ Methyl methoxycuprisalicylate, 829⁴.
- $C_9H_{10}FN_2O_4$ Anisaldehyde, 2-fluoro-, semicarbazone, 5177⁴.
Benzaldehyde, 4-fluoro-2-methoxy-, semicarbazone, 5177⁴.
- $C_9H_{10}HgO_2S$ Acetic acid, benzylmercurimercapto-, 3982⁷.
Acetic acid, tolylmercurimercapto-, 3982⁷.
- $C_9H_{10}INO_2$ Mesitylene, iodonitro-, 1406⁶.
- $C_9H_{10}INSe$ 1,2-Dimethylbenzoselenazoliun iodide, 142⁷.
- $C_9H_{10}N$ Benzimidazole, ethyl-, 141⁶, 1637⁹.
Ilydrocinnamonitrile, p -amino-, 1645⁴.
 p -Tolunitrile, α -methylamino-, and -HBr, 4450⁴.
- $C_9H_{10}N_2O$ 2-Benzimidazolecarbinol, α -methyl-, 141⁶.
- $C_9H_{10}N_2OS$ Benzothiazole, 1-amino-5-ethoxy-, 2245¹.
 p -Phenetidine, 2-thiocyano-, 2245¹.
- $C_9H_{10}N_2O_2$ Nicotinonitrile, 2,6-dihydroxy-4-isopropyl-, 3668⁴.
- $C_9H_{10}N_2O_2S$ Δ^3 -1,2,3-Thiodiazoline, 4-methyl-2-phenyl-, 1-dioxide, 4188¹.
- $C_9H_{10}N_2O_2$ Benzisoxazole, amino-, acetate, 827².
Hydrocinnamamide, *m*-nitro-, 5186³.
- $C_9H_{10}N_2O_2$ *o*-Acetotoluide, 4-hydroxy-6-nitro-, 1888¹.
Aniline, *N,N*-dimethyl-4,5-methylenedioxy-2-nitro-, 4204¹.
—, *N*-ethyl-4,5-methylenedioxy-2-nitro-, 4204¹.
Benzaldehyde, 5-ethoxy-2-nitro-, oxime, 3929⁴.
Carbanilic acid, *N*-methyl- p -nitro-, Me ester, 5171⁴.
Hydrocinnamic acid, β -amino-*m*-nitro-, -HCl, P 4777¹.
- $C_9H_{10}N_2S$ Benzothiazole, 1-amino-3,5-dimethyl-, 3705².
Benzothiazole, 3-methyl-1-methylamino-, 835⁶.
Benzothiazoline, 1-imino-2,3-dimethyl-, 835⁶.
- $C_9H_{10}N_2O$ Hydrasomethylene, 1-phenylazo-2-ethyl-1,3-endoxy-, and -HCl, 4939⁶.
- $C_9H_{10}N_2OS$ 1,3,4,6-Thiodiazine-2,5(3,4)-dione, 4-phenyl-, 2-hydrazone, and -HCl, 140⁶.
- $C_9H_{10}N_2O_2S$ 1,2,4-Triazole, 3-amino-5-(methylsulfonyl)-1-phenyl-, 2178².
- $C_9H_{10}N_2O_2$ 5-Pyrazolone, 1,1'-carbonylbis-[3-methyl-, 5164².
- $C_9H_{10}N_2O_2S$ p -Methanesulfonophenetide, 2,3,6-trinitro-, 2704².
- $C_9H_{10}N_2S$ s-Triazole, 3-amino-5-(benzylmercapto)-, and -HCl, 2178².
1,2,4-Triazole, 5-amino-3-(methylmercapto)-1-phenyl-, 2178².
- $C_9H_{10}NiO_4$ Methyl methoxynickelosalicylate, 829⁴.
- $C_9H_{10}O$ Chavicol, 3908².
Cinnamic alcohol, 122¹, P 155², 4837².
Ether, allyl phenyl, 3449⁹.
—, methyl α -methylenebenzyl, 2417¹.
—, methyl styryl, 2416³.
Hydrocinnamaldehyde, 4461².
Phenol, p -isopropenyl-, P 4229¹.
—, propenyl-, 2247¹, 3908².
Propiophenone, 4197².
Xylaldehyde, P 2446².
- $C_9H_{10}O_2$ (See also "ethyl ester" under *Benzoic acid*; *xylic acid*.)
Acetic acid, benzyl ester, 1348⁶.
Acetophenone, p -methoxy-, 2171¹.
Hydrocinnamic acid, 2165².
1,2-Indandiol, 2095⁹.
Phenol, p -(allyloxy)-, 2705⁹.

- 1 - Propanol, 2,3 - epoxyphenyl -, 4682^a.
 C₉H₁₀O₂S Benzoic acid, *m*-(ethylmercapto)-, 824⁷.
 Hydrocinnamic acid, *o* - mercapto -, 126⁸.
 C₉H₁₀O₂ (See also *Lactic acid, phenyl-*).
 Benzaldehyde, ethoxyhydroxy -, 1124², 1890^a, 4204¹.
 Benzoic acid, *o* - methoxy -, Me ester, 5182⁸.
 Bourbonal, 2676^a, 5130^a.
 Furanacrylic acid, Et ester, 3993⁷.
 Hydracrylic acid, phenyl-, 1669³.
 Isobourbonal, 2676^a.
 Isoxyaldehyde, 4,6 - dihydroxy -, 189⁴.
 Propiophenone, 3,4 - dihydroxy -, 2161⁵.
 Salicylic acid, Et ester, 3938³.
 Tropic acid, 1883³, 3455¹.
 Veratraldehyde, 2160¹.
 C₉H₁₀O₂S Benzoic acid, *m* - (ethylsulfinyl)-, 824⁷.
 C₉H₁₀O₂ Acetophenone, dihydroxymethoxy -, 1403^{3,4}, 2977⁷.
 Benzoic acid, 2,6 - dimethoxy -, 3454⁹.
 2,4 - Cresotic acid, 6 - methoxy -, 4477⁶.
 Evernic acid, 4477⁶.
 C₉H₁₀O₂S Benzoic acid, *m* - (ethylsulfonyl)-, 824⁷.
 Hydrocinnamic acid, *o* - sulfinio -, 126⁸.
 C₉H₁₀O₂ Syringic acid, 1405⁸.
 Veratric acid, 5 - hydroxy -, 3914⁸.
 C₉H₁₀O₂ Cyclobutanecetic acid, 2,3,4 - tri-carboxy - (?), 3674⁸.
 1,2,3,4 - Cyclopentanetetracarboxylic acid(?), 3674⁸.
 C₉H₁₁AsBrNO₂ Arsanilic acid, *N* - (α - bromopropionyl) -, 4463³.
 C₉H₁₁AsClNO₂ Acetanilide, (chloromethoxy-arsyl)hydroxy-, 119⁹, 120¹.
 C₉H₁₁AsClNO₂ Carbanilic acid, 5 - arsono - 2 - hydroxy-, β - chloroethyl ester, 842¹.
 C₉H₁₁AsN₂O₂ 5 - Benzimidazolearsonic acid, 2 - ethyl -, and salts, 2429⁹.
 C₉H₁₁AsN₂O₂ Benzimidazolearsonic acid, 2 - (α - hydroxyethyl) -, and Mg salt, 2429⁹.
 C₉H₁₁Br Mesitylene, 2 - bromo -, 5469⁹.
 C₉H₁₁BrO Benzyl alcohol, *p* - bromo - α - ethyl -, 2157⁸.
 Ether, γ - bromopropyl phenyl, 2162^a.
 C₉H₁₁Br₂NO₂ *p* - Anisidine, 2,6 - dibromo - *N* ethyl -, 3675¹.
 C₉H₁₁Br₂N₂S Urea, α - methylthio - β - *o* - tolyl-, bromine deriv., 835⁷.
 C₉H₁₁Cl Benzene, (α - chloropropyl) -, 4197¹.
 C₉H₁₁ClNO₂Sb Carbanilic acid, *p* - stibono -, *p* - chloroethyl ester, 598⁹.
 C₉H₁₁ClN₂O₂ Pyrazolecarboxylic acid, chloro-acetylmethyl-, Et ester, 1637^a.
 C₉H₁₁ClN₂O₂ Xanthine, 8 - chloro - 3,7 - diethyl-, 3903⁹.
 C₉H₁₁ClO Ether, chloromethyl phenethyl, 1871⁷.
 C₉H₁₁ClNO₂ *p* - Phenetidine, 3,5 - dichloro - 2 - methyl-, and -HCl, 1888⁹.
 C₉H₁₁KN₂O Benzoxazole, 1 - guanido -, methiodide, 4449⁹.
 C₉H₁₁K Cumene, K deriv., 5181¹.
 C₉H₁₁N Aniline, *p* - isopropenyl -, and -HCl, 4688⁸.
 Indoline, 2 - methyl-, 1635^{8,4}; and -HCl, 4709⁹.
 Quinolone, tetrahydro-, 4614⁹.
 Skatole, 2,3 - dihydro -, 1635⁹.
 C₉H₁₁NO Acetanilide, *N*-methyl-, 326⁹.
 Benzaldehyde, dimethylamino-, 123⁹, 381¹, 1717⁹.
 Formamide, *N*-phenethyl-, 2980⁹.
 Propionanilide, 4199¹.
 C₉H₁₁NO₂ (See also *Alanine, phenyl-*; *Benzosarcosine*.)
 Acetanilide, P 2535¹, 3674⁹.
 Acetophenone, hydroxymethylamino-, P 847⁷, 2497³, P 2723³.
 Benzoic acid, *p* - dimethylamino -, 1404¹.
 Carbanilic acid, ethyl ester, 1178⁹.
 —, *N*-methyl-, Me ester, 5171⁹.
 Glycine, *N*-benzyl-, -HCl, 840⁹.
 Homopiperonylamine, 3214².
 Hydrocinnamic acid, amino-, 126⁸; HCl, P 4777⁷.
 α-Tolualdehyde, *m*-methoxy-, oxime, 5177⁸.
 C₉H₁₁NO₂S β-Resorcyllamide, *N*-ethylthio-, 3218¹.
 C₉H₁₁NO₂ (See also *Tyrosine*.)
 Adrenalone, 4270⁹; -HCl, 5368⁸.
 Benzaldehyde, 4-ethoxy-3-hydroxy-, oxime, 1124².
 Benzamide, 2,6-dimethoxy-, 3455¹.
 Benzyl alcohol, α-(α-nitroethyl)-, 3689⁸.
 Benzylideneoximide, ethyl-3,4-dihydroxy-, 5162⁹.
 Isoleucine, β-phenyl-, 4684^{7,8}.
 Isoxyaldehyde, 4,6-dihydroxy-, oxime, 1894⁹.
 Mandalamide, *p*-methoxy-, 4687¹.
 C₉H₁₁NO₂S Benzamide, *N*-ethyl-2,4,6-trihydroxythio-, 3218¹.
 Benzene-sulfonamide, *p*-formyl-*N*-, *N*-dimethyl-, 4680⁹.
p-Toluenesulfonamide, *N*-acetyl-, P 1651⁷.
 C₉H₁₁NO₂ Alanine, β-(3,4-dihydroxyphenyl)-, 2706¹.
 C₉H₁₁NO₂ Syringic acid, amino-, and HCl, 1405¹.
 C₉H₁₁N₂O Guanidine, benzoylmethyl-, 3443¹.
 C₉H₁₁N₂O₂ Acetophenone, *o*-mercapto-, semi carbazone, 4700⁹.
 Pseudourea, γ-methyl-α phenylcarbamythio-, 3903⁹.
 C₉H₁₁N₂O₂ Biuret, 1-benzyl-, 3442⁴.
 Biuret, 1-methyl-1-phenyl-, 1889⁹.
 —, 1-*p*-tolyl-, 3442⁴, 4194⁸.
 C₉H₁₁N₂O₂ α-Toluic acid, α-semicarbazide-, 4685⁹.
 C₉H₁₁N₂O₂S Carbazic acid, β-(*p*-nitrophenylthio)-, Et ester, 2953¹.
 C₉H₁₁N₂O₂ Carbazic acid, β-(*o*-nitrophenyl) -, Et ester, 380⁴.
 C₉H₁₁N₂O₂ Phenethylamine, 4-methoxy 3,5-dinitro-, nitrate, 4705¹.
p-Phenetidine, 2-methyl-3,5-dinitro-, and -HCl, 1888⁹.
 C₉H₁₁N₂O₂S *p*-Methanesulfonophenetide, 2,6-dinitro-, 2704¹.
 C₉H₁₁N₂S 2-Thiazolidone, phenylhydrazone, 1299⁹.
 C₉H₁₁O₂P Hydrocinnamic acid, α-phosphono-, 4444⁴.
 C₉H₁₁ (See also *Cumene*; *Mesitylene*; *Pseudo-cumene*.)
 Benzene, propyl-, 318¹.
 1,8-Nonadiene, 4180⁹.
 Toluene, *p*-ethyl-, 2848⁹.
 C₉H₁₁Ag₂N₂, 1589⁹, 1587¹.
 C₉H₁₁AsNO₂ Alanine, *N*-(*p*-arsonophenyl)-, 2984⁹.
 β-Alanine, *N*-(*p*-arsonophenyl)-, 5471¹.
m-Arsanilic acid, *N*-acetyl-4-hydroxy 6-methyl-, P 2448⁹.

- $C_6H_{11}BrHgN$ Aniline, *p*-(bromomercuri)-*N*-ethyl-*N*-methyl-, 1889¹.
- $C_6H_{11}BrN$ *p*-Toluidine, 2-bromo-*N*, *N*-dimethyl-, P 606².
- $C_6H_{11}BrNO$ Ketone, 5-bromo-4-ethyl-2-methyl-3-pyrrol methyl, 2184³.
- $C_6H_{11}BrNO_2$ (Carboxymethyl)pyridinium bromide, Et ester, 3022⁴.
- 3-Pyrrolicarboxylic acid, 5-bromo-2,4-dimethyl-, Et ester, 2184³.
- $C_6H_{11}ClHgN$ Aniline, *p*-(chloromercuri)-*N*-ethyl-*N*-methyl-, 1889¹.
- $C_6H_{11}ClN$ *p*-Toluidine, 2-chloro-*N*, *N*-dimethyl-, P 606².
- $C_6H_{11}HgIN$ Aniline, *N*-ethyl-*p*-(iodomercuri)-*N*-methyl-, 1889¹.
- $C_6H_{11}NO_2Sb$ Carbanilic acid, *p*-stibono-, Et ester, 598⁵.
- $C_6H_{11}N_2O$ Alaninamide, 1112⁶.
- Benzaldehyde, *p*-dimethylamino-, 3681⁷.
- Nicotinonitrile, 2,3,4,5-tetrahydro-2-keto-4,4,6-trimethyl-, 2152⁷.
- Urea, α -ethyl- α -phenyl-, 3442⁸.
- , α -methyl- α -*p*-tolyl-, 1889².
- $C_6H_{11}N_2OS$ Carbazic acid, β -phenylthiono-, Et ester, 2953².
- $C_6H_{11}N_2O_2$ (See also *Dulcin*.)
- Anthrinaldehyde, 5-ethoxy-, oxime, 3029⁹.
- Benzylamine, *N*, *N*-dimethylnitro, and -*HCl*, 2428¹.
- 3-Indazolecarboxylic acid, 4,5,6,7-tetrahydromethyl-, 2971⁹, 2972¹⁰.
- 3-Isindazolecarboxylic acid, 4,5,6,7-tetrahydro-1-methyl-, 2971⁹.
- Lactamide, β -amino- β -phenyl-, 4684⁸.
- $C_6H_{11}N_2OS$ Urea, thiovanillyl-, 3452¹.
- $C_6H_{11}N_2O_2$ Phenethylamine, 4-methoxy-3-nitro-, and -*HCl*, 4705⁴.
- p*-Phenetidine, methylnitro, and -*HCl*, 1888².
- Urea, vanillyl-, 3452¹.
- $C_6H_{11}N_2O_4$ Aniline, 4,5-dimethoxy-*N*-methyl-2-nitro-, 4204⁹.
- $C_6H_{11}N_2O_4$ 4 - Pyrimidinecarboxylic acid, 5-ethoxy - 1,2,3,6 - tetrahydro - 2,6 - di keto-, Et ester, 1905⁴.
- $C_6H_{11}N_2OS$ *p*-Methanesulfonophenetide, 2-nitro-, 2704⁷.
- $C_6H_{11}N_2O_2S$ Benzenesulfonic acid, 5 (β -aminoethyl) - 2 - methoxy - 3 - nitro-, 4705⁴.
- $C_6H_{11}N_2S$ Urea, methylthiotolyl-, 835⁷.
- Urea, thio-2,4-xylyl-, 3705².
- $C_6H_{11}N_2OS$ Carbohydrazide, α -acetyl- δ phenylthio-, 1397⁷.
- $C_6H_{11}N_2O_4$ Uric acid, 3,7-diethyl-, 3903⁸.
- $C_6H_{11}O \Delta^1$ - 2 - Bicyclo[2.2.1]heptenealdehyde, 3-methyl-, 3692⁷.
- Ether, benzyl ethyl, 2170⁸.
- , isopropyl phenyl, 4660¹.
- , phenyl propyl, 4669¹.
- Isopseudocumenol, 3339².
- 1-Propanol, 3-phenyl-, 4937¹, 5074⁸.
- C_6H_7O Anisyl alcohol, α -methyl-, 2171⁴.
- Benzyl alcohol, *w*-methoxy- α -methyl-, 3451⁴.
- Ethanol, 2-benzoyloxy-, P 3931⁵.
- Methane, (benzoyloxy)methoxy-, 1871⁹.
- $C_6H_7O_2$ Benzene, 1,8,5-trimethoxy-, 1403¹.
- $C_6H_7O_2S$ *p*-Toluenesulfonic acid, Et ester, 1182².
- $C_6H_7O_4$ Malonic acid, (γ , γ -dihydroxy- α , α -dimethylbutyl)-, diaacetone, 2152⁷.
- $C_6H_7O_4$ *p*-Arabinal, diaethyl-, 3671¹.
- Bicyclo[2.2.1] - 7 - oxahепtane - 2,3 - dicarboxylic acid, mono-Me ester, 3691⁴.
- $C_6H_7O_4$ Methanetetra-carboxylic acid, tetramethyl ester, 5368⁹.
- C_6H_7S Sulfide, methyl phenethyl, 4670¹.
- $C_6H_7AsN_2O_4$ Arsanilic acid, *N*-(carbamyethyl)-, 2954⁸, 4463³; and *Na* salt, 5471¹.
- $C_6H_7ClO \Delta^1$ Cyclohepteneacetyl chloride, 4678⁴.
- $C_6H_7ClO_2$ Cyclopentaneacetic acid, 1-(chloroformyl)-, Me ester, 110⁴.
- C_6H_7N Aniline, *o*-propyl-, 1635⁵.
- Benzylamine, *N*, *p*-dimethyl-, and -*HBr*, 4450⁶.
- Indole, 4,5,6,7-tetrahydromethyl, 1635⁷, 4215²; and salts, 1635⁴.
- Toluidine, *N*, *N*-dimethyl-, 10⁶.
- C_6H_7NO (See also *Norephedrine*; *Norpseudoephedrine*.)
- Benzyl alcohol, α -(β -aminoethyl)-, 3912⁷.
- , *p*-dimethylamino-, and chloroplatinate, 1241¹.
- , α -(methylaminomethyl)-, P 1416⁷.
- Ketone, 4-ethyl-2-methyl-3-pyrrol methyl, 2184³.
- Phenethylamine, *p*-methoxy-, 2951⁴.
- p* Phenetidine, 2-methyl-, and -*HCl*, 1888².
- $C_6H_7NO_2$ (See also *Sympathol*.)
- Benzyl alcohol, α -(α hydroxaminoethyl)-, 3689⁵.
- 3-Pyrrolopropionic acid, 4-ethyl-, 1133⁸.
- $C_6H_7NO_2S$ Methanesulfonanilide, *N*-ethyl-, 2427⁶.
- $C_6H_7NO_2$ Acetoacetic acid, α -(β cyanoethyl)-, Et ester, 834⁴.
- Benzyl alcohol, 3,4-dihydroxy- α -(methylaminomethyl)-, P 2187².
- Nicotinic acid, 1,4,5,6-tetrahydro-6-keto-2-methyl-, Et ester, 101².
- $C_6H_7NO_2S$ *p*-Methanesulfonophenetide, 2427⁶, 2704⁷, 4668².
- $C_6H_7N_2O$ Semicarbazide, 4-(α -methylbenzyl)-, *HCl*, 1331¹.
- $C_6H_7N_2O_2$ 2-Butanone, 4-(2-furyl)-, semicarbazone, 5472⁸.
- $C_6H_7N_2O_3$ 3-Hydantoinacetic acid, Et ester, 2134⁴.
- $C_6H_7N_2O_3$ Biguanide, α -*p* anisyl-, • *HCl*, 4931⁸.
- $C_6H_7N_2O_2$ Caffeine, 8-methylamino-, 3211⁸.
- 2,4 - Pentanedione, (5-ethyl-3-5-triazolyl-azo)-, 3470⁹.
- C_6H_7 Apocyciene, 2168¹.
- Camphenilene, 2168¹.
- $C_6H_7AsNO_2$ See *Proparsanol*.
- $C_6H_7AsNO_2$ Diglycolarsenic acid, pyridine salt, 595².
- C_6H_7BrO Cyclopentanone, dibromo-3,3,4,4-tetramethyl-, 109⁴.
- $C_6H_7Cl_2N$ Trimethylphenylammonium dichloroiodide, 3706⁵.
- $C_6H_7Cl_2NO$ Valine, *N*-(*N*-dichloroacetyl)-, 1389⁶.
- $C_6H_7Cl_2O_2$ Adipyl chloride, β -isopropyl-, 4207⁹.
- $C_6H_7Cl_2NO_4$ 2,5-Piperazinedione, 1,4-dimethyl-, compd. with volatal, 140⁹.
- $C_6H_7NO_2Sb$ Benzenestibonic acid, *p*-(γ -hydroxypropylamino)-, 598⁵.
- $C_6H_7N_2$ Hydrazine, α -phenyl- α propyl-, -*HCl*, 4214².
- Isindazole, 4,5,6,7-tetrahydromethyl-, 2972¹⁰.
- Pimelonitrile, γ , γ -dimethyl-, 4673⁸.
- Pyrazole, 1-allyl-3,4,5-trimethyl-, 4700⁹.

- C₉H₁₄N₂O** Phenethylamine, 3-amino-4-methoxy-, *di-HCl*, 4705⁴.
p-Phenetidine, 2-(aminomethyl)-, and *HCl*, 3929⁴.
- C₉H₁₄N₂O₂** Nipeconitrile, 6-hydroxy-2-keto-4,4,6-trimethyl-, 2152².
 Spiro[cyclohexane - 1,3' - pyrrolidine] - 5'-one, 1'-nitroso-, 819².
- C₉H₁₄N₂O₂S** *p*-Toluenesulfonamide, *N*-(β -aminoethyl)-, 2183².
- C₉H₁₄N₂O₂S** Acetamidine, *p*-toluenesulfonate, 1895².
 Uracil, 5-ethoxy-6-(ethoxymethyl)-2-thio-, 1905².
- C₉H₁₄N₂O₄** Barbituric acid, 5-(ethoxymethyl)-5-ethyl-, 4744².
 1,4-Isoprenedicarbamic acid, di-Me ester, 4480².
 3,4 - Isopyrazoledicarboxylic acid, 3,5 - dihydro - 3,4 - dimethyl-, di - Me ester, 3705¹.
 α -Pentenic acid, γ -keto-, Me ester, carbethoxyhydrazone, 3704⁶.
 Pyrazolinedicarboxylic acid, dimethyl-, di-Me ester, and *HCl*, 3705².
 —, methyl-, ethyl methyl ester, 3704^{2,4}.
 Uracil, 5-ethoxy-6-(ethoxymethyl)-, 1905².
- C₉H₁₄N₄** Guanidine, α -(*p*-dimethylamino-phenyl)-, 1115².
- C₉H₁₄N₄O₂** See *Carnosine*.
- C₉H₁₄O** Apocamphor, 2168².
 2-Butanone, cyclopentyl-, 110⁴, 2946¹.
 —, cyclopentylidene-, 110⁴, 2946¹.
 Camphenilone, 2168².
 Camphorone, 4209¹.
 Cyclohexenealdehyde, dimethyl-, 3692^{2,4}.
 β -Fenchocamphorone, 3693².
 Isocamphenilone, 2168¹.
 Ketone, from ozonide of δ -fenchene, 3694².
 Nopinone, 830¹, 2167¹.
 2-Norcamphanealdehyde, 3-methyl-, 3692⁴.
 2-Propanone, 1- Δ^1 -cyclohexenyl-, 4454¹.
 —, 1-cyclohexylidene-, 4454¹.
 Sabinaketone, 2167².
 Tanacetophorone, 5-methyl-, 1625².
- C₉H₁₄O₂** Stannane, trimethylphenoxy-, 4670².
- C₉H₁₄O₂** Δ^1 - α -Cycloheptaneacetic acid, 4678².
 Δ^1 -Cycloheptaneacetic acid, 4678².
 Cyclohexanone, 2-acetonyl-, 2710^{2,4}.
 Cyclopentaneacetic acid, 1,1-(α -hydroxy-ethyl)-, γ -lactone, 110⁴.
 2-Norcamphaneacetic acid, 3-methyl-, 3692².
- C₉H₁₄O₂** Cyclohexanecarboxylic acid, 2-keto-, Et ester, 383⁴.
 Cyclopentaneacetic acid, 1-acetyl-, 110⁴.
 γ -Pentenic acid, α -acetyl-, Et ester, 2959⁴, 3207².
- C₉H₁₄O₄** Apocamphoric acid, 2168².
 Apofenchocamphoric acid, 2168², 3694¹.
 1,2 - Cyclohexanedicarboxylic acid, mono-Me ester, 4208^{2,4}.
 Cyclopentaneacetic acid, 1-carboxy-, mono-Me ester, 110⁴.
 Dicarboxylic acid, m. 117-8°, from ketone formed from ozonide of δ -fenchene, 3694².
 Δ^1 - 1,2 - Pentenediol(?) , diacetate, 2695².
- C₉H₁₄O₅** Anhydroglucose, monoacetone-, 108².
 Galactosan < α 1,5 > < β 1,6 > , 3,4-isopropylidene-, 3669².
 Glutaric acid, β -keto-, di-Et ester, 4218².
 Malonic acid, (γ -keto- α , α -dimethylbutyl)-, 2152².
 1,2 - Pyran - 3 - carboxylic acid, tetrahydro-
- 6 - hydroxy 2 - keto - 4,4,6 - trimethyl-, 2153².
- C₉H₁₅BrN₂O₄** Alanine, *N*-(*N*- α -bromopropionylalanyl)-, 1619⁴.
 Glycine, *N*-(*N*- α -bromoisovalerylglucyl)-, 1618², 4232².
 —, *N* - [α - (α - bromopropionylamino)butyryl]-, 1111².
- C₉H₁₅BrO₂** Octonaphtheneic acid, α -bromo-, Me ester, 1390².
- C₉H₁₅BrO₂** Glucose 6-bromohydrin, 1,2-monoacetone-, 108^{1,2}.
- C₉H₁₅ClN₂O₄** Glycine, *N*-(*N*-chloroacetylalanyl)-, 1619⁴.
 Valine, *N*-(*N*-chloroacetylglucyl)-, 4232².
- C₉H₁₅ClO₂** Butyric acid, γ -(chlorocarbonyl) β , β -dimethyl-, Et ester, 2153².
 Norisocampholoyl chloride, 1405².
- C₉H₁₅N** Indole, 2,3,4,5,6,7-hexahydro-2-methyl-, and salts, 1635^{2,4}.
 Pyrrole, 3,4-diethyl-2-methyl-, 2184².
- C₉H₁₅NO** (See also *Pseudopelletierine*.)
 Camphorone, oxime, 4209⁴.
 2(3)-Pyrrolone, 5-butyl-1-methyl-, 4469⁴.
 Spiro[cyclohexane - 1,3' - pyrrolidine] - 5'-one, and *HgCl₂* compd., 819².
- C₉H₁₅NO₂** Δ^1 - Cyclohexenecarboxylic acid, α -amino-, Et ester, 2957².
- C₉H₁₅NO₂S** Acetic acid, thiocyno-, hexyl ester, 4930².
- C₉H₁₅NO₂** Cyclopentaneacetic acid, 1-acetyl-, oxime, 110⁴.
 Proline, 1-acetyl-, Et ester, 5161².
 Pyrogutamic acid, 2,3,4,4-tetramethyl-, 110⁴.
- C₉H₁₅NO₂S** Cysteine, *N*-acetyl-, Et ester acetate, 5161².
- C₉H₁₅N₂O** Δ^1 - Cyclohexenealdehyde, methyl-, semicarbazone, 3692².
 2 - Norcamphanealdehyde, semicarbazone, 3692¹.
- C₉H₁₅N₂O** Semicarbazone, m. 195°, of aldehyde, 72-4°, 2084².
- C₉H₁₅N₂O₂S** See *Thionine*.
- C₉H₁₅N₂O₄** Glycine, propylglycyl-, 3484¹.
- C₉H₁₅** Cyclohexane, 1,1-dimethyl-3-methylene-, 4453².
 Cyclohexene, 1-ethyl-4-methyl-(?), 2848².
 —, 1-propyl-, 1886².
 Cyclopentene, 1,2-diethyl-, 109².
- C₉H₁₅BrNO** β - Alanine, *N* - (α - bromoisocaproyl)-, 1113⁴.
- C₉H₁₅Cl₂O** Caproic acid, β , β' -dichloroisopropyl ester, 3913².
- C₉H₁₅Cl₂O₄** Acetic acid, ethyl ester, compd. with CCl₄, 2641².
- C₉H₁₅N** Isopyrazole, 4,4-diethyl-3,5-dimethyl-, 4700².
 Pyrazole, 1,4-diethyl-3,5-dimethyl-, 4700².
 —, 1-isopropyl-3,4,5-trimethyl-, 4700².
 —, 3,4,5-trimethyl-1-propyl-, 4700².
- C₉H₁₅N₂O₂** Cyclopentanediamine, diacetyl-, 573².
 Piperidine, tetramethylnitroso-, 754².
- C₉H₁₅N₂O₂** Glycine, *N*, *N'*-carbonylbis-, di-Et ester, 2165².
- C₉H₁₅O** Cycloheptanone, 2,2-dimethyl-, 2702².
 Cyclohexanepropionaldehyde, 5168².
 Cyclopentanone, isopropylmethyl-, 1625¹, 2702².
 —, 2-methyl-5-propyl-, 2702².
 4-Heptanol, 4-ethyl-, 4673².
 Norisocamphaldehyde, 1405².

- $C_7H_{13}O_2$ Cyclohexanecarboxylic acid, Et ester, P 154¹, P 2980⁷.
1,2-Cyclopentanediol, 1-methyl-, acetone compd., 2701¹.
Norisocampholic acid, 1405¹.
 β -Pentenic acid, α,β -dimethyl-, Et ester, 96¹.
 $C_7H_{13}O_2$ Pelargonic acid, γ -keto-, 4469¹.
 $C_7H_{13}O_2$ (See also *Asoleic acid*.)
Adipic acid, β -isopropyl-, and Na salt, 4206¹, 4207^{1,2}.
Glutaric acid, β,β -dimethyl-, mono-Et ester, and Ag salt, 2153¹.
Malonic acid, dipropyl-, 5162¹; and di-Na salt, 4871¹.
Pimelic acid, γ,γ -dimethyl-, 4673¹.
Suberic acid, mono-Me ester, 3663¹.
 $C_7H_{13}O_2$ Anhydrofructose, trimethyl-, 3907¹.
Anhydroglucose, 2,3,6-trimethyl-, 1116¹.
 $C_7H_{13}O_2$ Glucose, monoacetone-, 106¹, 4450¹.
 δ -Mannonolactone, 3,4,6-trimethyl-, 2423¹.
 $C_7H_{13}Br$ 2-Heptene, 7-bromo-2,6-dimethyl-, 4668¹.
 $C_7H_{13}BrO_2$ Pelargonic acid, θ -bromo-, 3663¹.
 $C_7H_{13}ClIN$ Tropane, 3-chloro-, methiodide, 2183¹.
 $C_7H_{13}Cl_2CoN$, 2385¹.
 $C_7H_{13}CoN_2O_2S$ Co-cysteine complex, 5207¹.
 $C_7H_{13}IN_2$ Isopyrazole, 3,4,4,5-tetramethyl-, ethiodide, 4700¹.
 $C_7H_{13}N$ Indole, octahydro-2-methyl-, 1635¹, and salts, 144¹.
 $C_7H_{13}NO$ (See also *Novonal*.)
Conhydrinone, methyl-, 1131¹.
Cycloheptanone, 2,2-dimethyl-, oxime, 2702¹.
Cyclopentanone, 4-isopropyl 2-methyl-, oxime, 1625¹.
Granataninol, *N*-methyl-, 3019¹.
Isopelletierine, methyl-, 1131¹.
4-Piperidone, 1-butyl-, -HCl, 1902¹.
2-Propanone, 1-(3-methyl-1-piperidyl)-, and -HCl, 601¹.
 $C_7H_{13}NO_2$ Cyclohexanecarboxylic acid, 2-amino-, Et ester, 2957¹.
Granataninol, *N*-methyl-, *N*-oxide, 3019¹.
1-Piperidineacetic acid, Et ester, HBr, 3022¹.
 $C_7H_{13}N_2O$ Cycloheptanone, 2-methyl-, semicarbazone, 2702¹.
Cyclohexanecarboxaldehyde, 2-methyl-, semicarbazone, 3692¹.
 Δ^1 -3-Heptenone, 5-methyl-, semicarbazone, 96¹.
Hexenone, dimethyl-, semicarbazone, 96¹.
 α -Pentaldehyde, β,γ,γ -trimethyl-, semicarbazone, 1614¹.
 $C_7H_{13}N_2O_2$ Caproamide, δ -amino- α -cyano- δ -hydroxy- β,β -dimethyl-, 2152¹.
 $C_7H_{13}N_2O_2$ Caproic acid, δ -keto- β,β -dimethyl-, semicarbazone, 2153¹.
Caprylic acid, γ -keto-, semicarbazone, 2702¹.
Levulinic acid, trimethyl-, semicarbazone, 110¹.
 $C_7H_{13}N_2O_2$ Alanine, *N*-(*N*-alanylalanyl)-, 1619¹.
Glycine, *N*-(α -alanylaminoethyl)-, 1111¹.
—, *N*-(*N*-glycylvalyl)-, 1619¹.
—, *N*-(*N*-valylglycyl)-, 4232¹; and Cu salt, 1619¹.
Valine, *N*-(*N*-glycylglycyl)-, 4232¹.
 $C_7H_{13}N_2O_2$ Cyclohexane, 1,3,5-trimethyl-, 3897¹.
Heptene, dimethyl-, 4668¹.
 $C_7H_{13}AsCl$ Araine, chlorocyclohexylpropyl-, 121¹.
 $C_7H_{13}BrO_2$ Butyraldehyde, α,α -dibromo- β -methyl-, di-Et acetal, 2151¹.
 $C_7H_{13}ClIN$ Δ^1 -Butenylamine, α -chloro-*N*, *N*-diethyl- β -methyl-, 3208¹.
Cyclohexanecethylamine, 3-chloro-*N*-methyl-, and salts, 1131¹.
 $C_7H_{13}Cl_2NO_2$ Ethanol, 2-trichloro-1-[α -(dimethylaminomethyl)- α -methylpropoxy]-, -HCl, 374¹.
 $C_7H_{13}CoN_2S_2 + H_2O$, 2900¹.
 $C_7H_{13}HgO_2$ Heptane, 1-(acetoxymethyl)-, 1871¹.
 $C_7H_{13}IN$ Tropane, methiodide, 2183¹.
 $C_7H_{13}LiN_4$ Hexamethylenetetramine, ethiodide, compd. with $CHCl_3$, 1871¹.
 $C_7H_{13}N_2O_2$ Adipamide, β -isopropyl-, 4207¹.
Camphorohydroxylamine, oxime, 4209¹.
Pimelamide, γ,γ -dimethyl-, 4673¹.
 I_2 Piperazinecarboxylic acid, 4-ethyl-, Et ester, 2183¹.
 $C_7H_{13}N_2O_2$ β -Alanine, *N*-leucyl-, 1113¹.
Glycine, *N*-leucyl-, Me ester, -HCl, 603¹.
—, *N*-(*N*-methylleucyl)-, 1389¹.
Leucine, alanyl-, 1147¹.
—, *N*-(8-aminopropionyl)-, 2991¹.
1-Piperazinecarboxylic acid, 4- β -hydroxyethyl-, Et ester, 2183¹.
 $C_7H_{13}N_2O_2$ Glycine, *N*-(β -carboxyaminoethyl)-, di-Et ester, 2183¹.
Isoserine, leucyl-, 2730¹.
5,5'-Spiro[*m*-dioxane], 2,2'-bis(aminomethyl)-, 4672¹.
 $C_7H_{13}N_2O_2S$ Methionamide, *N*, *N'*-diacetyl-, *N*, *N'*-diethyl-, 98¹.
 $C_7H_{13}O$ Cyclopentanol, 1,2-diethyl-, 109¹.
Enanthaldehyde, α,α -dimethyl-, 2934¹.
Ether, cyclohexyl isopropyl, 3673¹.
—, cyclohexyl propyl, 3673¹.
—, ethyl Δ^1 -heptenyl, 2416¹.
3-Pentanone, 2,2,4,4-tetramethyl-, 1872¹.
 $C_7H_{13}O_2$ Butyric acid, α,α -dimethyl-, Pr ester, 3438¹.
1,1-Cyclohexanedicarbinol, 4-methyl-, 4672¹.
Desoxyaucubigenin, tetrahydro-, 393¹.
m-Dioxane, 2-isopropyl-5,5-dimethyl-, 1615¹.
1,3-Dioxolane, 2,2-dipropyl-, 4671¹.
Enanthic acid, α,α -dimethyl-, 2934¹.
2-Hexanone, 3-hydroxy-3-propyl-, 4673¹.
Pelargonic acid, 4469¹.
 $C_7H_{13}O_2$ Caprylic acid, η -hydroxy-, Me ester, 3663¹.
Carbonic acid, di-Bu ester, 1058¹; diisobutyl ester, 1058¹.
Pelargonic acid, θ -hydroxy-, 1386¹, 1389¹, 3663¹.
Valeric acid, β -hydroxy- α,β -dimethyl-, Et ester, 96¹.
—, α -hydroxy- α -propyl-, Me ester, 4673¹.
 $C_7H_{13}O_2$ Lyxoside, trimethylmethyl-, 1881¹.
Xyloside, trimethyl- α -(and β)-methyl-, 4450¹.
 $C_7H_{13}O_2$ *d*-Glucose, 3,5,6-trimethyl-, 4450¹.
Glucoside, 2-methyl- β -ethyl-, 1881¹.
Triacetone cycloperoxide, 5008¹.
 $C_7H_{13}As_2Cl_2O_2$ Compd., b.p. 35°, from 3-hydroxy-1-propanearsonic acid, 92¹.
 $C_7H_{13}BrO$ 1-Nonanol, 9-bromo-, 3663¹.
 $C_7H_{13}BrO_2$ Butyraldehyde, α -bromo- α -methyl-, di-Et acetal, 2151¹.
 $C_7H_{13}ClIN$ γ -Chloroallyltriethylammonium iodide, 2150¹.
 $C_7H_{13}Cl_2N$ Butylamine, α,α -dichloro-*N*, *N*-diethyl- β -methyl-, 3208¹.
 γ -Chloroallyltriethylammonium iodide, 2150¹.

- C₉H₁₉N Cyclohexylamine, *N*-isopropyl-, and -HCl, 111⁹.
Diethylamine, *N*- α -methyl- Δ^2 -butenyl-, P 3052⁷.
C₉H₁₉NO Butyramide, *N*, *N*-diethyl- α -methyl-, 3208⁴.
Conhydrine, methyl-, 1132¹.
Piperidineethanol, dimethyl-, and -HCl, 602¹.
—, ethyl-, 1902⁵.
1-Propanol, 2-cyclohexylamino-, and -HCl, 111⁸, 112³.
Propionaldehyde, β -dipropylamino-, 3209³.
C₉H₁₉NO₂ 1 - Piperidinepropanol, β - methoxy-, P 3234⁷.
C₉H₁₉NO₃ Isobutyric acid, β -dimethylamino- α -hydroxy-, Pr ester, 374³.
C₉H₁₉N₂O Caproaldehyde, β , δ -dimethyl-, semicarbazone, 1615⁴.
Heptanone, methyl-, semicarbazone, 1614⁵, 3455⁴, 3702⁷.
C₉H₁₉O₃P Propionic acid, α -phosphono-, tri-Et ester, 4444⁷.
C₉H₁₉ Heptane, dimethyl-, 1386⁴, 2421³.
Hexane, 2,2,5-trimethyl-, 1386⁴.
Nonane, 1554⁴, 3897⁴.
C₉H₁₉AsCl₃ Arsine, dichloro(γ -hexylamino-propyl)-, -HCl, 92⁹.
C₉H₁₉BrNO₃ Galactosido <1,5>trimethylammonium bromide, 3669⁹.
C₉H₁₉ClNO (2 - Hydroxycyclohexyl)trimethylammonium chloride, 4269⁹.
Triethyl(α - hydroxyallyl)ammonium chloride, 2150⁶.
C₉H₁₉Cl₂O₂ Ethyl ether, compd. with CCl₄, 2841³.
C₉H₁₉INO₃ γ - Hydroxy - β - methoxypropyltrimethylammonium iodide, acetate, P 3234⁷.
C₉H₁₉N₂ Cyclopentenylamine, 2-(α -aminoisopropyl)-5-methyl-, 4209⁹.
C₉H₁₉N₂O Urea, α , α -dibutyl-, 3442⁹.
C₉H₁₉N₂S Carbamic acid, dithio-, cyclohexylethylamine salt, 4374³.
C₉H₁₉N₂O₂ Propionaldehyde, β -propylamino-, semicarbazone, acetate, 3209⁴.
C₉H₁₉N₂O₂S₂ Methionamide, *N*, *N*'-dibutyl-, *N*, *N*'-dinitro-, 98⁷.
C₉H₁₉O 3-Heptanol, 3-ethyl-, 2420³.
4-Heptanol, 3,3-dimethyl-, 2420⁷.
Nonyl alcohol, 4142⁷, 5074⁹.
3-Pentanol, 2,2,3,4-tetramethyl-, 2420³.
C₉H₁₉O₂ Formaldehyde, di-*tert*-butyl acetal, 2420⁶.
1,9-Nonanediol, 3663⁴.
C₉H₁₉O₃ 2,4,6-Heptanetriol, 2,6-dimethyl-, P 4952³.
Orthopropionic acid, tri-Et ester, 2639⁶.
C₉H₁₉O₄ Orthocarbonic acid, tetra-Et ester, 2639⁶.
C₉H₁₉O₄S See *Tetronal*.
C₉H₁₉ClIN₃O [(Butylcarbamyl)methyl]trimethylammonium chloride, 3023¹.
C₉H₁₉Cl₂O₂ Ethyl ether, compd. with CHCl₃, 2641⁶.
C₉H₁₉NO₂ 1-Propanol, 3-diethylamino-2-ethoxy-, P 3234⁷.
Propionaldehyde, β -diethylamino-, dimethyl acetal, 3209³.
C₉H₁₉NO₂S Methanesulfonamide, *N*, *N*-dibutyl-, 2427⁷.
C₉H₁₉P Phosphine, tripropyl-, and H₂Cl₂ compd., 4441⁹.
C₉H₁₉AsNO₃ 1-Propanecarsonic acid, 3-hexylamino-, -HCl, 92⁹.
C₉H₁₉IN Triethylpropylammonium iodide, 1638⁴.
C₉H₁₉N₂O₂S₂ Methionamide, *N*, *N*'-dibutyl-, 98⁷.
C₉H₁₉INO₂⁹ γ -Hydroxy- β -methoxypropyltrimethylammonium iodide, monoester of ethylphosphoric acid, P 3234⁴.
C₉H₁₉NO Hexyltrimethylammonium hydroxide, 2419⁸.
C₉H₁₉Br₂CoN₄ Diethylenediaminediaminocyclopentane cobaltic bromide, 573⁷.
C₉H₁₉Cl₂CoN₄O₂ Diethylenediaminediaminocyclopentane cobaltic perchlorate, 573⁷.
C₉H₁₉Co₂IN₄ Diethylenediaminediaminocyclopentane cobaltic iodide, 573⁷.
C₉H₁₉Co₂N₄O₂ Diethylenediaminediaminocyclopentane cobaltic nitrate, 573⁷.
C₁₀H₁₇Br Naphthalene, hexabromo-, 4937¹.
C₁₀H₁₇Cl₂O₂ 1,3 - Benzodioxan - 6 - ol, 5,7 - dichloro - 2,4 - bis(dichloromethylene)-, 599¹.
C₁₀H₁₇BrN₂O₂ 2,3-Quinoxalinedicarboxylic anhydride, 6 bromo-, 3473³.
C₁₀H₁₇ClN₂O₂ 2,3 - Quinoxalinedicarboxylic anhydride, 6-chloro-, 3473³.
C₁₀H₁₇Cl₂NO Naphthoquinone, dichloronitro-, P 715⁴, P 1512³, P 3934⁴.
C₁₀H₁₇Cl₂N₂O β -Naphthoxadiazole, 3,4-dichloro-, 1897⁴.
C₁₀H₁₇Cl₂NO₂ 1,3 - Benzodioxan, 2(or 4)-(di-chloromethylene) - 6 - nitro - 4(or 2)-(trichloromethyl)-, 3662¹.
C₁₀H₁₇Cl₂O₂ 1,3 - Benzodioxan - 6 - ol, 5,7 - dichloro - 2,4 - bis(trichloromethyl)-, 599¹.
C₁₀H₁₇N₂O₂ 2,3 - Quinoxalinedicarboxylic anhydride, 3473³.
C₁₀H₁₇BrN₂O β - Naphthoxadiazole, 3 - bromo-, 1897³.
C₁₀H₁₇BrN₂O₂ 2,3 - Quinoxalinedicarboxylic acid, 6-bromo-, and ammonium salt, 3473³.
C₁₀H₁₇Br₂O 2 - Naphthol, 1,3,6-tribromo-, 4466⁴.
C₁₀H₁₇ClN₂O β -Naphthoxadiazole, 3-chloro-, 1897³.
C₁₀H₁₇ClN₂O₂ Naphthalene, chlorodinitro-, 3923³.
2,3 - Quinoxalinedicarboxylic acid, 6 - chloro - and ammonium salt, 3472³, 3473³.
C₁₀H₁₇Cl₂NO₂ 2-Naphthol, 3,4-dichloro-1-nitroso-, 1897⁴.
C₁₀H₁₇Cl₂N₂O₂ 1,3 - Benzodioxan, (chloromethylene)(dichloromethyl) - 6,8 - di-nitro-, 2975⁶.
C₁₀H₁₇N₂O₂ 2,3-Quinoxalinedicarboximide, 3472³.
C₁₀H₁₇BrClOS 2-Naphthalenesulfinyl chloride, 1-bromo-, 2172⁴.
C₁₀H₁₇BrClO₂S 2-Naphthalenesulfonyl chloride, 1-bromo-, 2172⁴.
C₁₀H₁₇Br₂N₂O Ketone, 4,5-dibromo-2-imidazolyl phenyl, 1639⁶.
C₁₀H₁₇Br₂O 2-Naphthol, dibromo-, 4466⁴.
C₁₀H₁₇Br₂N₂ Quinoxaline, 5,6,7,8-tetrabromo-2,3-dimethyl-, 2979⁶.
C₁₀H₁₇ClINO Quinaldyl chloride, 2182⁴.
C₁₀H₁₇ClINO₂ Naphthalene, chloronitro-, 3023³.
2-Naphthol, 3-chloro-1-nitroso-, 1897⁴.
C₁₀H₁₇Cl₂ Naphthalene, dichloro-, 1897¹.
C₁₀H₁₇Cl₂O 2-Naphthol, 3,4-dichloro-, 1897⁴.
C₁₀H₁₇Cl₂O₂S Naphthalenesulfonyl chloride, chloro-, 1897⁴.
C₁₀H₁₇Cl₂O₂S₂ 1,5-Naphthalenedisulfonyl chloride, 2160⁴, P 2192⁴.
C₁₀H₁₇Cl₂NO₂ 1,3-Benzodioxan, (chloromethylene)(dichloromethyl)-, 2975⁶.

- $C_{10}H_8Cl_2N_2O_4$ 1,3-Benzodioxan, 2,4-bis(dichloromethyl)-6,8-dinitro-, 2975³.
- $C_{10}H_8Cl_2N_2O$ Hydrazine, α -acetyl- β -(β -trichloroethylidene)- α -(2,4,6-trichlorophenyl)-, 824³.
- $C_{10}H_8N_2$ 3-Quinolinenitrile, 4218⁸.
- $C_{10}H_8N_2OS$ Carbostryl, 4-thiocyano-, 2245².
- $C_{10}H_8N_2O_4$ Naphthalene, dinitro-, 4212⁸, 4856⁷.
- $C_{10}H_8N_2O_4$ 2,3-Quinoxalinedicarboxylic acid, and ammonium salt, 3472⁷, 3473¹.
- $C_{10}H_8N_2O_5$ Naphthol, dinitro-, 904³, 3730⁵, 4460⁹, 4407¹.
- $C_{10}H_8N_2O_5S$ Naphthol yellow, 2964⁵.
- $C_{10}H_8N_2O_6$ 8-Quinolinedicarboxylic acid, 5,7-dinitro-, 3227⁹.
- $C_{10}H_8NiS_2$ 1,8-Naphthylenedimercaptan, Ni deriv., 135⁸.
- $C_{10}H_8O_2$ See *Naphthoquinone*.
- $C_{10}H_8O$ Puril, 4944².
- Maleic anhydride, hydroxyphenyl-, 2959³.
- $C_{10}H_8O_2$ 2,1-Benzopyran-1,3(4)-dione, 6,7-methylenedioxy-, 599⁹.
- $C_{10}H_8S_2$ *peri*-Naphthodithiol, 135⁸.
- $C_{10}H_8Br$ See *Naphthalene, bromo-*.
- $C_{10}H_8BrClO_2$ 1,3-Benzodioxan, 6 bromo-2,4-bis(dichloromethyl)-, 2975³.
- $C_{10}H_8BrMg$ Naphthylmagnesium bromide, 2934¹, 4442⁹, 4467⁸.
- $C_{10}H_8BrN_2O_2$ 5-Pyrazolecarboxylic acid, 4-bromo-3-phenyl-, 3704⁸.
- $C_{10}H_8BrO$ 2-Naphthol, bromo-, 833⁷, 1897¹, 4466⁸.
- $C_{10}H_8BrO_5S$ 2-Naphthalenesulfonic acid, 1-bromo-, 2172⁴.
- $C_{10}H_8BrO_6$ Hemipic anhydride, 6 bromo-, 4222⁸.
- $C_{10}H_8Br_2N_2OS$ Δ^2 -1-Pyrazolinedicarboxamide, 4,4-dibromo-5-keto-3-phenylthio-, 388³.
- $C_{10}H_8Br_2N_2O_2$ Δ^2 -1-Pyrazolinedicarboxamide, 4,4-dibromo-5-keto-3-phenyl-, 388³.
- $C_{10}H_8Br_2Cl_2N_2O_3$ 2,4-Bis(dichloromethyl)-1,3-benzodioxan-6-diazonium perbromide, 2975³.
- $C_{10}H_8Cl$ See *Naphthalene, chloro-*.
- $C_{10}H_8ClHg$ Naphthalene, (chloromercuri)-, 5172⁵.
- $C_{10}H_8ClO$ 2-Naphthol, 3-chloro-, 1897¹.
- $C_{10}H_8ClO_2S$ Thionaphthalenealdehyde, chlorohydroxymethyl-, P 2447¹.
- $C_{10}H_8ClO_3$ Chromone, 2-chlorohydroxy-6-methyl-, 2441¹.
- $C_{10}H_8ClO_5S$ Naphthalenesulfonic acid, chloro-, 1899⁹.
- $C_{10}H_8Cl_2NO$ 2-Naphthol, 1-amino-3,4-dichloro-, 1897¹.
- $C_{10}H_8Cl_3O$ 1-Indanone, 4,5,7 trichloro-3-methyl-, 126⁸.
- $C_{10}H_8Cl_4NO_4$ 1,3-Benzodioxan, 2,4-bis(dichloromethyl)-6-nitro-, 2975³.
- $C_{10}H_8Cl_4N_2O_4$ 2,4-Bis(dichloromethyl)-1,3-benzodioxan-6-diazonium chloride, 2975³.
- $C_{10}H_8Cl_4O_5S$ 1,3-Benzodioxan-6-sulfonyl chloride, 2,4-bis(dichloromethyl)-, 2975³.
- $C_{10}H_8NO_2$ Benzonitrile, *m*-(β -hydroxyacryl)-, 827¹.
- Isoquinoline, 6,7-methylenedioxy-, 2444².
- Naphthol, nitroso-, 1897¹, 2434^{1,2}.
- Quinaldic acid, 3706⁸.
- $C_{10}H_8NO_2$ (See also *Kynurenic acid*.)
- 1-Naphthol, nitro-, 3697¹, 4466⁸.
- $C_{10}H_8MO_5S$ Cinchoninic acid, 1,2-dihydro-2-keto-3-mercaptop-, 2443³.
- Δ^2 α Indolineacetic acid, 2-keto- α mercapto-, 2443³.
- $C_{10}H_8NO$ Propionic acid, *o*-nitrophenyl-, Me ester, 1636².
- $C_{10}H_8NO_5S$ 2-Naphthol-6-sulfonic acid, 1-nitroso-, *Na* salt, 2434⁷.
- $C_{10}H_8NO_6S$ Naphthylsulfonic acid, nitro-, *K* salt, 2160⁷.
- $C_{10}H_8N_2O_5$ 2-Quinoxalinecarboxylic acid, 3-carbamyl-, 3472⁸.
- $C_{10}H_8N_2O_5S$ Δ^2 -1,3,4-Thiodiazoline-4-carboxylic acid, 2-benzalamino-5-keto-, 2953⁸.
- $C_{10}H_8N_2O_6$ 8-Quinolinedicarboxylic acid, 5-nitro-, 3227⁹.
- $C_{10}H_8N_2O_6$ Urea, α -nitro- β -(5-nitro-8-quinolyl)-, 3228².
- $C_{10}H_8NaO_2$ 2-Naphthol, *Na* deriv., 3462⁷.
- $C_{10}H_8NaO_5S$ 2-Naphthol-1-sulfonic acid, *Na* deriv., *Na* salt, 2431^{1,2}.
- $C_{10}H_8$ See *Naphthalene*.
- $C_{10}H_8AgN_2O_2$ Norpinimide, 1,3-dicyano-, *Ag* deriv., 1398⁸.
- $C_{10}H_8AgN_2O_5$ Malonamic acid, *N*-(α -carbamyl- α -cyanoacetyl)- α -cyano-, *Et* ester, di-*Ag* deriv., 4193⁸.
- $C_{10}H_8AsN_2$ Pyridine, 3,3'-arsenobis-, 1641⁸.
- $C_{10}H_8BaN_2O_5$ Malonamic acid, *N*-(α -carbamyl- α -cyanoacetyl)- α -cyano-, *Et* ester, *Ba* deriv., 1193⁸.
- $C_{10}H_8BrClN_2O_2$ Glyoxylic acid, bromo-, *Et* ester, (2,4,6-trichlorophenyl)hydrazone, 824³.
- $C_{10}H_8BrNO$ Naphthol, aminobromo-, 1897¹, P 2304¹.
- $C_{10}H_8BrNOS$ Benzisothiazole, 1-acetyl-1,2-dihydro-2-methylene-, 4700⁸.
- $C_{10}H_8BrNO_2$ Pseudosatin, 1-(β -bromoethyl)-, 2971¹.
- $C_{10}H_8BrNO_3$ 1,2,3-Butanetrione, 1-(β -bromophenyl)-, 2-oxime, 5175⁵.
- $C_{10}H_8BrN_2O_1$ Piperonal, 6 bromo-, oxamylhydrazone, 4201⁸.
- $C_{10}H_8BrHgO_4$ Benzene, bis(acetoxymethyl)-1,4-dibromo-, 3216².
- $C_{10}H_8BrClN_2O_2$ Glyoxylic acid, chloro-, *Et* ester, (2,4,6-tribromophenyl)hydrazone, 824³.
- $C_{10}H_8BrN_2O_2$ Glyoxylic acid, bromo-, *Et* ester, (2,4,6-tribromophenyl)hydrazone, 824³.
- $C_{10}H_8ClHgN$ Quinaldine (chloromercuri)-, 839⁵.
- Quinoline, (chloromercuri)methyl-, 839⁵.
- $C_{10}H_8ClN$ 2-Naphthylamine, 1-chloro-, P 2986¹.
- Quinaldine, 8-chloro-, P 2185¹.
- $C_{10}H_8ClNO$ 2-Naphthol, 1-amino-3-chloro-, 1897¹.
- $C_{10}H_8ClNO_5S$ Acetic acid, (5-chloro-2-cyano-methylmercapto)-, P 5195¹.
- Naphthalenesulfonamide, chloro-, 1897¹.
- $C_{10}H_8ClNO_4$ Hydrocinnamic acid, chloro-, α,β diketo-, Me ester, α oxime, 3218⁷.
- $C_{10}H_8ClNS$ Benzothiazolone, 5-chloro-2-methyl-1-methylene-, CS_2 addn. compd., 390⁸.
- $C_{10}H_8ClNO_4$ Piperonal, 6-chloro-, oxamylhydrazone, 4201⁸.
- $C_{10}H_8Cl_2O$ 1-Indanone, dichloromethyl-, 126⁸, P 1416².
- $C_{10}H_8Cl_2NO_2$ Glyoxylic acid, chloro-, *Et* ester, (2,4,6-trichlorophenyl)hydrazone, 824³.
- $C_{10}H_8Cl_3O$ Hydrocinnamyl chloride, 2,3,5-trichloro- β -methyl-, 126⁸.
- $C_{10}H_8Cl_4O_3$ Anisic acid, 3 ($\alpha,\alpha,\alpha,\beta$ -tetrachloroethyl)-, 599⁹.
- $C_{10}H_8Cl_4O_5S$ 1,3-Benzodioxan-6-sulfonic acid,

- 2,4-bis(dichloromethyl)-, and NH₄ salt, 2975⁵.
- C₁₀H₈CuN₂O₂ 2-Pyrrolealdehyde, Cu compd., 4698⁷.
- C₁₀H₈HgO Naphthalene, 1-(hydroxymercuri)-, 1870⁹.
- C₁₇H₈Hg₂O₂ Compd., darkens 210°, from resorcinol and Hg(OAc)₂, 1401¹.
- C₁₀H₈N₂ 2,2'-Bipyridine, 143⁹.
- C₁₀H₈N₂O Quinaldamide, 2182⁹.
- 3-Quinolincarboxamide, 4218⁹.
- C₁₀H₈N₂O₂ 1-Naphthylamine, 5-nitro-, 3697⁶.
- 3-Quinolincarboxylic acid, 2-amino-, 839⁶.
- C₁₀H₈N₂O₂ Acetanilide, 2-cyano-4,5-methylene-dioxy-, 1404⁹.
- 3-Quinolincarboxamide, 2,4-dihydroxy-, 4218⁷.
- C₁₀H₈N₂O₂ 4,9-Dipyrrozopyrazinedione, dimethyl-, 1637⁷.
- C₁₀H₈N₂O₂ Δ²-1-Pyrazolincarboxamide, 4,5-diketo-3-phenylthio-, 4-oxime, 388⁹.
- C₁₀H₈N₂O₂ Δ²-1-Pyrazolincarboxamide, 4,5-diketo-3-phenyl-, 4-oxime, 388⁹.
- Urea, (5-nitro-8-quinolyl)-, 3227⁹.
- C₁₀H₈N₂O₄ Hydrazine, α-acetyl-β-5-nitro-2-benzisoxazolylicarbonyl-, 2073⁹.
- C₁₀H₈N₂O₄ Piperonal, 6-nitro-, oxamylhydrazone, 4204¹.
- C₁₀H₈O See *Naphthol*.
- C₁₀H₈O₂ Furan, 2,2'-vinylentbis-, 2436⁹.
- Naphthalenediol, P 1139⁴, 1362¹, 4466⁴.
- C₁₀H₈O₂ (See also *Umbelliferone*, methyl-.)
- Chromone, hydroxy-6-methyl-, 2441¹.
- Herniarin, 3773⁹.
- C₁₀H₈O₂S (See also *Naphthalenesulfonic acid*.)
- Thiochromone, 2,3-dihydroxy-6-methyl-, 2440¹.
- C₁₀H₈O₄ Coumarin, 8-hydroxy-7-methoxy-, 2718².
- Furoin, 4944¹, 3.
- Scopoletin, 4900¹.
- C₁₀H₈O₄S Naphtholsulfonic acid, 3697⁶, P 3716⁴.
- C₁₀H₈O₄ 1-Isobenzofurancarboxylic acid, 1,2-dihydro-2-keto-4-methoxy-, 2183⁹.
- C₁₀H₈O₄S 1-Naphthalenesulfonic acid, 8-sulfino-, and Na salt, 135⁷.
- C₁₀H₈O₄ 1,2,3,4-Cyclohexanetetra-carboxylic dianhydride, 3674⁶.
- Piperonylic acid, 6-hydroxy-, acetate, 1404⁹.
- C₁₀H₈O₄S 2-Naphtholdisulfonic acid, and salts, P 1418⁹.
- C₁₀H₈S 1,8-Naphthylenedimercaptan, 135⁷.
- C₁₀H₈AN₂Cl₂O₂ 1,4-Benzisoxazin-3-ol, 8-acetamido-6-dichloroarsyl-, 841⁷.
- C₁₀H₈AN₂O₂ 1,4-Benzisoxazin-3-ol, 8-acetamido-6-aminoso-, 841⁷.
- C₁₀H₈BrHg₂O₂ Benzene, 2,4-bis(acetoxymercuri)-1-bromo-, 3216³.
- C₁₀H₈BrN₂O₂ Furazan, 3-(bromo-*p*-anisyl)-4-methyl-, 1788⁷.
- C₁₀H₈BrN₂O₂ 1,2,3-Butanetrione, 1-(*p*-bromophenyl)-, dioxime, 5175⁴.
- 1,2,8,6-Dioxiazine, 4-(bromo-*p*-anisyl)-5-methyl-, 1788⁷.
- Furoxan, 4-(bromo-*p*-anisyl)-3-methyl-, 1788⁷.
- C₁₀H₈BrO₂ 1,3-Butanedione, 1-(*p*-bromophenyl)-, 5175⁴.
- C₁₀H₈BrO₂ Hemipic acid, 6-bromo-, 4223⁹.
- C₁₀H₈BrN₂O₂ Glyoxylic acid, Et ester, (2,4,6-tribromophenyl)hydrazone, 824⁶.
- C₁₀H₈Cl 1,3-Butadiene, 1-chloro-4-phenyl-,
- C₁₀H₈ClHg₂O₂ Phenol, bis(acetoxymercuri)-chloro-, 3216³.
- C₁₀H₈ClN₂O 5-Pyrazolone, 1-(*o*-chlorophenyl)-3-methyl-, 1900¹, 2176⁹, 4700¹.
- C₁₀H₈ClN₂O₂ 1-Propanol, 3-chloro-, 3,5-dinitrobenzoate, 2422⁹.
- C₁₀H₈ClO^Δ 2-Butenone, 4-(*m*-chlorophenyl)-, 831¹.
- 1-Indanone, chloromethyl-, 126⁶, P 1418¹.
- C₁₀H₈ClO₂ 2-Thiochromanone, 6-chloro-4-methyl-, 126⁶.
- C₁₀H₈ClO₂ Hydrocoumarin, 6-chloro-4-methyl-, 126⁶.
- C₁₀H₈ClO₂ Acetic acid, chlorobenzoyl-, Me ester, 3218⁹.
- C₁₀H₈ClO₂ *o*-Toluic acid, 6-(carboxymethyl mercapto)-4-chloro-, P 3478⁴.
- C₁₀H₈Cl₂NO₂ Acetoacetanilide, 2,5-dichloro-, 835¹.
- C₁₀H₈Cl₃ Benzene, (γ, δ, 8-trichloro-Δ¹-butenyl)-, 4466⁹.
- C₁₀H₈Cl₃N₂O₂ Glyoxylic acid, Et ester, (2,4,6-trichlorophenyl)hydrazone, 824⁶.
- C₁₀H₈Cl₃O Hydrocinnamyl chloride, dichloromethyl-, 126⁶.
- C₁₀H₈Cl₃O₂ Hydrocinnamic acid, 2,3,5-trichloro-β-methyl-, 126⁶.
- 2,5-Xylenol, 3,4,6-trichloro-, acetate, 3674⁴.
- C₁₀H₈Cl₄N₂O₂ 1,3-Benzodioxan, 6-amino-2,4-bis(dichloromethyl)-, and -HCl, 2975⁴.
- C₁₀H₈Cl₄NO₂ 1,3-Benzodioxan-6-sulfonamide, 2,4-bis(dichloromethyl)-, 2975⁴.
- C₁₀H₈Cl₅ Benzene, α, β, γ, δ, 8-pentachlorobutyl-, 4466⁹.
- C₁₀H₈Hg₂NO₂ Phenol, bis(acetoxymercuri) nitro-, 3216³, 3.
- C₁₀H₈N (See also *Naphthylamine*.)
- Atroponitrile, β-methyl-, 2166⁷.
- Cinnamonitrile, α-methyl-, 2166⁴.
- Quinaldine, P 2185⁹, 4218⁹.
- C₁₀H₈NO Naphthol, amino-, P 2304¹, 3463⁹, 3697⁶, P 4829⁹.
- α-Tolunitrile, α-acetyl-, 1126⁴.
- C₁₀H₈NO₂ Benzisothiazole, 1-acetyl-1,2-dihydro-2-methylene, 4700¹.
- Thionaphthene, 2-acetamido-, 3468⁷.
- C₁₀H₈NO₂ Carbostyryl, 3-methoxy-, 2442¹.
- Hydrocinnamic acid, *o*-cyano-, 126⁶.
- Isoquinoline, 3,4-dihydro 6,7-methylene-dioxy-, 2444¹.
- Mandelonitrile, acetate, 590⁶.
- 2,3-Pyrroledione, 4,5-dihydro-4-phenyl-, 4463⁹.
- C₁₀H₈NO₂S Acetic acid, thiocyno-, benzyl ester, 4930⁹.
- C₁₀H₈NO₂ 3,4-Chromandione, 6-methyl-, mon-oxime, 2441¹.
- o*-Veratraldehyde, 5-cyano-, 2166⁹.
- C₁₀H₈NO₂S Acetic acid, thiocyno-, *o*-anisyl ester, 4930⁹.
- Naphthionic acid, 4956⁴.
- C₁₀H₈NO₂ Saffrole, nitro-, P 4713¹.
- C₁₀H₈NO₂S Naphtholsulfonic acid, amino-, 1369⁴, 1820¹.
- Naphthylsulfuric acid, amino-, and K salt, 2160⁹.
- C₁₀H₈NO₂ Acetophenone, α-hydroxy-*p*-nitro-, acetate, 826⁹.
- Piperonylic acid, 6-acetamido-, 1404⁹.
- C₁₀H₈NO₂ Malonic acid, *m*-nitrobenzyl-, 5186¹.
- Pyrocatechol, 4-nitro-, diacetate, 8677⁴.
- C₁₀H₈NO₂S Naphtholdisulfonic acid, amino-, 4125⁴.
- C₁₀H₈N₂ Pyridine, 2,2'-iminotol-, P 4778⁹.

- C₁₀H₈N₂O** Urea, quinolyl-, 1903^a, 3228^a.
C₁₀H₈N₂OS Δ¹-1-Pyrazolincarboxamide, 5-keto-3-phenylthio-, 388^a.
C₁₀H₈N₂O₂ Compd., m. 259°, from 2-methyl-5-phenyl-1,3,4-triazole-1-*o*-benzoic acid, 836^a.
 Dimicotinonitrile, 2,6-dihydroxy-4-*isopropyl*-, ammonium deriv., 3668^a.
 Norpinimide, 1,3-dicyano-, 1398^a.
 Δ¹-1-Pyrazolincarboxamide, 5-keto-3-phenyl-, 388^a.
 α-Tolunitrile, 3,4-diformamido-, 141^a.
C₁₀H₈N₂O₂S 1,3,4-Thiadiazolid-2-one, 4-acetyl-5-phenylimino-, 2974^a.
C₁₀H₈N₂O₂ Δ¹-5-Pyrazolincarboxylic acid, 1-nitroso-3-phenyl-, 3704^a.
C₁₀H₈N₂O Furazan, 3-methyl-4-(nitro-*p*-anisyl)-, 1788^a.
C₁₀H₈N₂O₂ 1,2,3,6-Dioxiazine, 4-methyl-5-(nitro-*p*-anisyl)-, 1788^a.
 Furoxan, 3-methyl-4-(nitro-*p*-anisyl)-, 1788^a.
C₁₀H₈N₂S Thiazole, 4-methyl-2-phenylazo-, 1410^a.
C₁₀H₁₀ 1,3-Butadiene, 1-phenyl-, 4460^a.
C₁₀H₈AgCl₂N₂O₂Rh + 2H₂O, 4217^a.
C₁₀H₈AgCl₂N₂Rh, 4217^a.
C₁₀H₈BrClO₂ Hydrocinnamic acid, 2-bromo-5-chloro-β-methyl-, 126^a.
C₁₀H₈Br₂FeN, 353^a.
C₁₀H₈Br₂O Benzaldehyde, *p*-(β,γ-dibromopropyl)-, 3908^a.
 2-Naphthol, 1,3-dibromo-5,6,7,8-tetrahydro-, 4466^a.
C₁₀H₈Br₂O Benzene, 4-(α,β-dibromopropyl)-1,2-methyleneedioxy-, 5174^a.
 Benzoic acid, *p*-(β,γ-dibromopropyl)-, 3908^a.
p-Toluic acid, α,α-dibromo-, Et ester, 138^a.
C₁₀H₈Br₂O₂ Δ¹-1,2-Cyclohexenedicarboxylic anhydride, 3,6-bis(bromomethyl)-, 3674^a.
C₁₀H₈Br₂O₂ Divaric acid, 3,5-dibromo-, 1632^a.
C₁₀H₈Br₂N₂OS Compd., m. 140°, from α-acetylthio-α-*o*-tolylurea and bromine, 835^a.
C₁₀H₈Br₂N₂OS Compd., m. 255-8°, from 1-acetamido-3-methylbenzothiazole, 835^a.
C₁₀H₈ClNO 1-Indanone, 4-chloro-7-methyl-, oxime, 126^a.
C₁₀H₈ClNO₂ Acetoacetamide, *o*-chloro-, 835^a.
C₁₀H₈ClNO₂S Acetic acid, (2-carbamylethyl-*m*-tolylmercapto)-, P 1010^a, P 3235^a, P 3478^a.
C₁₀H₈ClNO₂S 2-Oxazolidone, 5-(chloromethyl)-3-(phenylsulfonyl)-, 2177^a.
C₁₀H₈Cl₂ Benzene, (γ,δ-dichloro-Δ¹-butenyl)-, 4460^a.
C₁₀H₈Cl₂FeN, 353^a.
 Hydrocinnamyl chloride, chloromethyl-, 126^a.
C₁₀H₈Cl₂O₂ Hydrocinnamic acid, dichloromethyl-, 126^a.
C₁₀H₈Cl₂O₂ Salicylic acid, β,β'-dichloroisopropyl ester, 3913^a, 4685^a.
C₁₀H₈Cl₂NO 2,5-Acetoxyliide, 3,4,6-trichloro-, 3674^a.
C₁₀H₈Cl₄ Benzene, α,β,γ,δ-tetrachlorobutyl-, 4460^a.
C₁₀H₈Cl₄KN₂Rh + H₂O, 4217^a.
C₁₀H₈CoI₂N₂ Cobaltous iodide dipyrindine, 5125^a.
C₁₀H₈CoN₂O₂ Compd. of Co(NO₂)₂ and pyridine, 3180^a.
C₁₀H₈Hg₂O₂ Resorcinol, anhydromercuri-acetoxymercuriethyl-, 1401^a.
C₁₀H₈I₂O₂ Salicylic acid, β,β',δ'-diiodoisopropyl ester, 3913^a.
C₁₀H₈I₂N₂Rh, 4904^a.
- C₁₀H₁₀N₂** Naphthylenediamine, 1231, 1797^a.
 Nicotyrine, 1690^a.
 Pyridine, 3-(1-methyl-2-pyrryl)-, 148^a.
 Quinoxaline, 2,3-dimethyl-, 2978^a.
C₁₀H₁₀N₂O Carbostyryl, 1-methyl-, oxime, and salts, 3897^a.
 5-Pyrazolone, 3-methyl-1-phenyl-, P 613^a, 1900^a, P 4485^a.
 Quinoline, 8-amino-6-methoxy-, and *di-HCl*, P 1995^a.
C₁₀H₁₀N₂OS Benzothiazole, 1-acetamido-3-methyl-, 835^a.
 Benzothiazoline, 2-acetyl-1-imino-3-methyl-, 835^a.
C₁₀H₁₀N₂OS₂ 2-Thiazolidone, 3-(phenylthiocarbonyl)-, 2177^a.
C₁₀H₁₀N₂O₂ Furazan, 3-*p*-anisyl-4-methyl-, 1788^a.
 1,3,4,6-Oxidazin-5(4)-one, 2-methyl-4-phenyl-, 1452^a.
C₁₀H₁₀N₂O₂S 1-Benzimidazolecarboxylic acid, 2,3-dihydro-2-ketothiono-, Et ester, 2953^a.
 1-Benzimidazolecarboxylic acid, 2,3-dihydro-2-thioketo-, Et ester, 2953^a.
 Thiazole, 2-(aminomethyl)-4-(3,4-dihydroxyphenyl)-, *di-HCl*, 3470^a.
 —, 4-(3,4-dihydroxyphenyl)-2-methylamino-, *HCl*, 3470^a.
C₁₀H₁₀N₂O₂ 1,4-Benzisoxazin-3-ol, acetamido-, 840^a, 841^a, 842^a.
 1,2,3,6-1,1-dioxiazine, 4-*p*-anisyl-5-methyl-, 1788^a.
 Furoxan, 4-*p*-anisyl-3-methyl-, 1788^a.
 Quinaldic acid, 1,2,3,4-tetrahydro-1-nitroso-, 1411^a.
C₁₀H₁₀N₂O₂ Acetoacetanilide, *p*-nitro-, 835^a.
 Glutaconic acid, α,γ-dicyano-, Et Me ester, 375^a.
 Homoveratronic acid, 2-nitro-, 2980^a, 5177^a.
 Norpinic acid, 1,3-dicyano-, 1398^a.
C₁₀H₁₀N₂O₂S 2-Naphthol 6-sulfonic acid, 3,4-diamino-, *stannichloride*, 2964^a.
C₁₀H₁₀N₂O₂S₂ 1-Naphthol-3,8-disulfonamide, P 3816^a.
C₁₀H₁₀N₂O₂ Acetic acid, (4-acetamido-2-mitrophenoxy)-, 841^a.
 Styrene, 2,4-dimethoxy-β,5-dinitro-, 4455^a.
C₁₀H₁₀N₂O₂ Tartaric acid, *p*-nitro-, 5507^a.
C₁₀H₁₀N₂O₂S₂ Methionine acid, (benzylcarbamyl)-cyano-, 3205^a.
 Methionine acid, cyanotolylcarbamyl-, 3205^a.
C₁₀H₁₀N₂O Hydrazomethylene, 1-phenylazo-2-allyl-1,3-endoxy-, and *HCl*, 4930^a.
C₁₀H₁₀N₂O₂S Compd., m. 201.2°, from CH₃(COCN)₂ and α-phenylthiocarbohydrazide, 1398^a.
C₁₀H₁₀N₂O₂ Malonic acid, *N*-(α-carbamyl-α-cyanoacetyl)-α-cyano-, Et ester, 4193^a.
C₁₀H₁₀N₂O₂ Carbanilic acid, *N*-methyl-2,4,6-trinitro-, Et ester, 5171^a.
C₁₀H₁₀N₂O₂ Creatinine, picrate, 4449^a.
C₁₀H₁₀O Benzaldehyde, *p*-allyl-, 3908^a.
 Benzaldehyde, *p*-propenyl-, 3908^a.
 Benzyl alcohol, α-ethinyl-α-methyl-, 1614^a.
 Δ²-2-Butenone, 4-phenyl-, 2171^a.
 Cinnamaldehyde, methyl-, 1615^a, P 3714^a.
 Crotonophenone, P 3477^a.
 1-Indanone, methyl-, P 606^a, P 1415^a, P 1416^a.
C₁₀H₁₀O₂ (See also *Isosafrole*, *Safrole*)
 2(1) - Benzofuranone, 3,5-dimethyl-, 1122^a.
 Benzoic acid, *p*-allyl-, 3908^a.
 —, *p*-propenyl-, 3908^a.

- Butanedione, phenyl-, 1339^a, 1877^a, 1891^a, 2424^a, 3912^a, 4214^a, 4683^a, 4941^a.
- 2-Butanone, 3,4-epoxy-4-phenyl-, 4683^a.
- Δ³-2-Butenone, 3-hydroxy-4-phenyl-, 1891^a.
- Cyclopropanecarboxylic acid, Ph ester, 4454^a.
- C₁₀H₁₀O₃ Cinnamic acid, *p*-methoxy-, 1396^a; NH₄ salt, 2432^a.
- Δ^{2,4} - 1,2 - Cyclohexadienedicarboxylic anhydride, 3,6-dimethyl-, 3692^a.
- Δ⁴ - 1,2 - Cyclohexenedicarboxylic anhydride, 3-ethylidene-, 3674^a.
- Ethylene oxide, α-methyl-β-(3,4-methylenedioxypheyl)-, 2162^a, 4472^a.
- Ferulaldehyde, 2982^a, 3906^a.
- C₁₀H₁₀O₄ Bicyclo[2.2.1]-7-oxa-5-heptene-2,3-dicarboxylic anhydride, 1,4-dimethyl-, 3691^a.
- Δ⁴ - 1,2 - Cyclohexenedicarboxylic acid, 3,6-bis(hydroxymethyl)-, diactone, 3674^a.
- Glyoxylic acid, *p*-anisyl-, Me ester, 1128^a.
- Hydrocinnamic acid, *m*-carboxy-, 137^a.
- Phthalic acid, dimethyl ester, 2081^a.
- Terephthalic acid, di-Me ester, P 154^a, 2081^a.
- C₁₀H₁₀O₄ Δ³ - 1,2,3 - Cyclohexanetricarboxylic acid, 6-methyl-, 1,2-anhydride, 3674^a.
- 1,3,5 - Cyclohexanetrione, 2,4 - diacetyl-, 1403^a.
- 2 - Furancarboxylic acid, hydroxymethyl-, acetate, 2175^a.
- Isopropionic acid, 2166^a.
- C₁₀H₁₀O₄ 2-Propenesulfonic acid, 1 (3,4-methylenedioxypheyl)-, 1628^a.
- C₁₀H₁₀O₄ Isophthalic acid, 2-hydroxy-4-methoxy-6-methyl-, 4478^a.
- Terephthalic acid, 2,6-dihydroxy-, di-Me ester, 1120^a.
- C₁₀H₁₀O₄ Acetic acid, α,α'-[4,6-dihydroxy-*m*-phenylenedithio]bis-, 826^a.
- C₁₀H₁₁AsCl₂N₂O₄ Phenylthioarsinous acid, 4-chloro-3-nitro-, di(carbamylmethyl) ester, 3678^a.
- C₁₀H₁₁AsCl₂N₂O₄ Benzenearsonic acid, 3,5-bis(α-chloroacetamido)-4-hydroxy-, 1400^a.
- C₁₀H₁₁AsN₂O₄ Phenol, 2,4 diacetamido-6-arsinono-, 119^a.
- C₁₀H₁₁AsN₂O₄ 1,4 - Benzisoxazinearsonic acid, acetamidohydroxy-, 842^a.
- 1,4 - Benzisoxazinearsonic acid, aminohydroxy-, acetyl deriv., 841^a.
- C₁₀H₁₁Br Benzene, 1-bromo-4-butenyl-, 2157^a, 3908^a.
- C₁₀H₁₁BrClMgN α-(γ-Chloropropyl)benzalam-magnesium bromide, 2438^a.
- C₁₀H₁₁BrO₂ *p*-Toluic acid, α-bromo-, Et ester, 138^a.
- C₁₀H₁₁BrO₂ Glycerol, α-*p*-bromobenzoate, 2939^a.
- C₁₀H₁₁Br₂NO₂ Acetanilide, dibromo-2,6-dimethoxy-, 1401^a.
- C₁₀H₁₁Br₂ Benzene, 1-bromo-4-(β,δ-dibromobutyl)-, 2157^a.
- C₁₀H₁₁Br₂N₂O₂ Compd., m. 173°, from α-acetylthio-α-*o*-tolylurea and bromine, 835^a.
- C₁₀H₁₁ClINOS 4(?) - Chloro-5-methoxy-1,2-dimethylbenzothiazolium iodide, 390^a.
- C₁₀H₁₁ClINOS 5-Chloro-1,2,3-trimethylbenzothiazolium iodide, 390^a.
- C₁₀H₁₁ClIN₂O₂ Hydrazine, β-acetyl α-chloroacetyl-*o*-phenyl-, 145^a.
- C₁₀H₁₁ClIN₂O₂ Oxazolidine, 5-(chloromethyl)-2-imino-3-(phenylsulfonyl)-, 2177^a.
- C₁₀H₁₁ClO Butyrophenone, γ-chloro-, 2439^a.
- C₁₀H₁₁ClO Acetophenone, α-chloro-2-hydroxy-4,6-dimethyl-, 1122^a.
- Hydrocinnamic acid, chloromethyl-, 1264^a.
- m*-Toluic acid, α-chloro-, Et ester, 138^a.
- C₁₀H₁₁ClO₂ Hydrocinnamic acid, 5-chloro-2-mercaptop-β-methyl-, 126^a.
- C₁₀H₁₁ClO₂ Butyric acid, β-chloro-α-hydroxy-β-phenyl-, 1616^a.
- Homopiperonyl alcohol, α-(chloromethyl)(?), 4683^a.
- Hydrocinnamic acid, 2-chloro-5-methoxy-, 126^a.
- 1-Propanol, 2-chloro-3-(3,4-methylenedioxyphenyl)-(?), 4683^a.
- C₁₀H₁₁ClO₂ Acetyl chloride, (2,3-dimethoxyphenoxy)-, 4481^a.
- C₁₀H₁₁Cl₂NO₂ *p*-Acetophenetide, 2,6(and 3,5) dichloro-, 3910^a.
- Hydrocinnamic acid, 2-amino-3,5 dichloro β-methyl-, 126^a.
- C₁₀H₁₁Cl₃O Phenetole, 2,4,5-trichloro-3,6 dimethyl-, 3674^a.
- C₁₀H₁₁N Indole, 2,3-dimethyl-, 834^a.
- Indole, 1-ethyl-, P 2185^a.
- C₁₀H₁₁NO Atropamide, β-methyl-, 2166^a.
- C₁₀H₁₁NOS Benzothiazoline, 5-methoxy-2-methyl-1-methylene-, 390^a.
- C₁₀H₁₁NO₂ Acetoacetanilide, 835^a.
- Cinnamaldehyde, α-methoxy-, oxime, 3681^a.
- 1,2-Propanedione, 1-*p*-tolyl-, 2-oxime, 3912^a.
- Quinaldic acid, 1,2,3,4-tetrahydro-, and -HCl, 1411^a.
- C₁₀H₁₁NO₂S Benzothiazole, 4,5-dimethoxy-1-methyl-, 3467^a.
- C₁₀H₁₁NO₂ Homopiperonylamine, N formyl-, 2444^a.
- C₁₀H₁₁NO₂S Benzamide, N-allyl-2,3,5 trihydroxythio-, 3218^a.
- C₁₀H₁₁NO₂S 2-Thiazolidone, 3-*p*-tolylsulfonyl-, 2177^a.
- C₁₀H₁₁NO₂ *m*-Dioxane, 2-(*p*-nitrophenyl)-, 596^a.
- Hydrocinnamic acid, β-amino-3,4 methylenedioxy-, -HCl, P 4777^a.
- Malonic acid, (α-aminobenzyl)-, 1892^a.
- Pyrocatechol, 4-amino-, diacetate, 3677^a.
- Styrene, 2,4-dimethoxy-β-nitro-, 4455^a.
- C₁₀H₁₁NO₂ Benzaldehyde, 4 ethoxy-5 methoxy-2-nitro-, 843^a.
- 5-*m*-Dioxanol, 2-(*p*-nitrophenyl)-, 596^a.
- 1,3-Dioxolane-4-carbinol, 2-(*p*-nitrophenyl)-, 596^a.
- Hydrocinnamic acid, 4-methoxy-3-nitro-, 4705^a.
- 3-Pyrrolepropionic acid, 5-carboxy-2-formyl-4-methyl-, 1134^a.
- Syringic acid, methylenecamino-, 1405^a.
- C₁₀H₁₁NO₂ 3-Pyrrolepropionic acid, 2,5-dimethoxy-4-methyl-, 1133^a.
- C₁₀H₁₁N₂ 1,3,4-Triazole, 2,5-dimethyl-1-phenyl-, 836^a.
- C₁₀H₁₁N₂O₂ 1,3,4-Thiadiazolid-2-one, 5-ethylimino-, 2974^a.
- C₁₀H₁₁N₂O₂ Pyruvic acid, phenyl-, semicarbazone, 4685^a.
- C₁₀H₁₁N₂O₂ Pyruvic acid, methyl(*p*-nitrophenyl)hydrazone, 4700^a.
- C₁₀H₁₁N₂O₂ Carbamic acid, N-methyl-2,4-dinitro-, Et ester, 5171^a.
- C₁₀H₁₁N₂O₂ Acetanilide, 2,3-dimethoxy-5,6-dinitro-, 5174^a.
- C₁₀H₁₁N₂S₂ Thiazolidine, 2-imino-3 (phenylthiocarbonyl)-, 2177^a.
- Δ³ - Thiazoline, 2-(β-phenylthiocarbonyl)-, 2177^a.

- $C_{10}H_{11}N_3S$ 1, 2, 4 - Triazole - 1 - carboxanilide, 3-amino-5-methylthio-, 1639⁹.
 Urea, α - (5 - methyl-3-s-triazolyl)- β -phenylthio-, 1630⁹.
- $C_{10}H_{12}$ (See also *Decalin*; *Tetralin*.)
 Benzene, butenyl-, 1870⁹, 3908¹.
 Perylene, 3627¹.
- $C_{10}H_{12}AsClN_2O_2S_2$ Phenylthioarsinous acid, 4-chloro-, di(carbamylmethyl) ester, 3678¹.
- $C_{10}H_{12}AsNO_2S_2$ Phenylthioarsinous acid, 4-amino-, di(carboxymethyl) ester, 3677¹.
- $C_{10}H_{12}AsNO_2$ 1, 4-Benzisoxazine-6-arsonic acid, 2-ethyl-3-hydroxy-, 841⁹.
- $C_{10}H_{12}AsNO_2S_2$ Phenylthioarsinous acid, 3-amino - 4 - hydroxy-, di(carboxymethyl) ester, 3677¹.
- $C_{10}H_{12}AsNO_2$ Acetic acid, (2-acetamido-4 arsonophenoxy)-, 841⁹.
- $C_{10}H_{12}AsN_2O_2$ 1, 4-Benzisoxazine-6-arsonic acid, 8-aminoacetamido-3-hydroxy-, 841⁹.
 1, 4 - Benzisoxazine - 6 - arsonic acid, 8 (carbamylmethylamino)-3-hydroxy-, 841⁹.
- $C_{10}H_{12}AsN_2O_2$ Acetic acid, arsonoformylphenoxo-, semicarbazone, P 4023¹.
- $C_{10}H_{12}BrNOS$ 5-Methoxy-1, 2-dimethylbenzothiazolium bromide, 390⁹.
- $C_{10}H_{12}BrNO_2$ Benzene, 2-bromo-1 *tert*-butyl 4-nitro-, 115¹.
- $C_{10}H_{12}BrNO_2$ Acetanilide, 3-bromo 2, 6-dimethoxy-, 1401⁹.
- $C_{10}H_{12}Br_2$ Benzene, (α, β -dibromobutyl)-, 3908¹.
- $C_{10}H_{12}Br_2CoN_2$ Dipyridinium cobaltous bromide, 5125⁴.
- $C_{10}H_{12}ClN$ Benzalimine, α -(γ -chloropropyl)-, and -HCl, 2438⁹.
- $C_{10}H_{12}ClNO_2$ Hydrocinnamic acid, aminochloromethyl-, 1261¹.
- $C_{10}H_{12}ClNO_2$ Ether, butyl 2-chloro 4-nitrophenyl-, 117⁹.
- $C_{10}H_{12}ClNO_2S_2$ 4-Chloro-1, 2-dimethylbenzothiazolium methylsulfate, 1900⁷.
- $C_{10}H_{12}ClNO_2S$ 5-Methoxy-1, 2-dimethylbenzothiazolium perchlorate, 390⁹.
- $C_{10}H_{12}Cl_2N_2ORh$, 4217⁴.
- $C_{10}H_{12}Cl_2CoN_2$ Dipyridinium cobaltous chloride, 5125⁴.
- $C_{10}H_{12}HgN_2O_4$ Caffeine, 8-(acetoxymethyl)-, 1622¹.
- $C_{10}H_{12}HgO_4$ Resorcinol, 4-(acetoxymethyl)-6-ethyl-, 1401¹.
- $C_{10}H_{12}INOS$ 5-Methoxy-1, 2-dimethylbenzothiazolium iodide, 390⁹.
- $C_{10}H_{12}INS_2$ 2-Ethyl-1-methylbenzoseleazolium iodide, 142⁷.
- $C_{10}H_{12}N_2$ Benzimidazole, 1-propyl-, 1637⁹.
 Indole, 3-(β -aminoethyl)-, 834², 2419⁹; -HCl, 834².
- $C_{10}H_{12}N_2O$ Cinnamaldehyde, *p*-methoxy-, hydrate, 3911⁹.
 Quinazoline, 6-ethoxy-3, 4-dihydro-, 3929⁹.
- $C_{10}H_{12}N_2O_2$ Homoveratrolnitrile, 2-amino, 5177⁹.
 α -Tolamide, *o*-acetamido-, 4700¹.
- $C_{10}H_{12}N_2O_2S_2$ Thiazolidine, 2-imino-3-*p*-tolylsulfonyl-, 2177⁹.
- $C_{10}H_{12}N_2O_2$ α -Toluic acid, α -(aminoacetamido)-, 2697⁹, 2698⁹.
- $C_{10}H_{12}N_2O_2$ *p*-Acetophenetide, 2-nitro-, 5173⁹.
 Aniline, 4, 6 - methylenedioxy - 2 - nitro - *N* propyl-, 4204⁴.
 Carbanilic acid, *N*-ethyl-*p*-nitro-, Et ester, 5171⁹.
 Hydrocinnamamide, 4-methoxy - 3 - nitro -, 4703⁴.
- $C_{10}H_{12}N_2O_2$ Acetanilide, dimethoxynitro-, 5174⁹.
 Carbanilic acid, 4 methoxy-2-nitro-, Et ester, 5173⁹.
 Tartarilic acid, *p*-amino-, 5507⁴.
- $C_{10}H_{12}N_2S$ Benzothiazole, 3, 5-dimethyl-1-methylamino-, and -HCl, 3705⁹.
 Benzothiazoline, 1-imino-2, 3, 5-trimethyl, and -HCl, 3705⁴.
 Urea, allylphenylthio-, 3215¹, 4870⁴.
- $C_{10}H_{12}N_4O_2$ Guanidine, hippuryl-, 1621⁹.
- $C_{10}H_{12}N_4O_2$ Picramide, 3, 5-diethoxy-, 823⁹.
- $C_{10}H_{12}N_4O_2S$ *p*-Ethanesulfonophenetide, 2, 3, 6-trinitro-, 2704⁹.
- $C_{10}H_{12}N_6O_2S_2$ [4, 4'-Bi- Δ^2 -pyrazoline]-1, 1'-diarboxamide, 5, 5'-diketo-3, 3'-dimethyl-, 388⁹.
- $C_{10}H_{12}N_6O_4$ [4, 4'-Bi- Δ^2 -pyrazoline]-1, 1'-dicarboxamide, 5, 5'-diketo-3, 3'-dimethyl-, 388⁹.
- $C_{10}H_{12}N_2O_3$ Δ^2 -Oxazoline, 2-amino-5-(aminomethyl)-, picrate, 2177².
- $C_{10}H_{12}NiO_4$ Methyl ethoxynickelosalicylate, 829⁹.
- $C_{10}H_{12}O$ (See also *Anethole*.)
 Benzyl alcohol, α -propenyl-, 2948⁹.
m-Cresol, 6 isopropenyl-, P 4229¹.
 Ethylene oxide, α, α -dimethyl- β -phenyl-, 2958⁹.
 Isobutyrophenone, 125⁹.
 Phenol, *p*-isobutenyl-, P 4229¹, 4680⁹.
 α Tolualdehyde, 3, 4-dimethyl-, P 4483¹.
- $C_{10}H_{12}O_2$ (See also *Eugenol*; *Isoeugenol*.)
 Acetophenone, 2-hydroxy-4, 6-dimethyl-, 1122¹.
 Benzaldehyde, *p*-propoxy-, 1396⁹.
 Butyric acid, phenyl-, 1669⁹.
 Dicyclopentadiene oxide, ketotetrahydro-, 1623⁹.
 Naphthalenediol, 1, 2, 3, 4-tetrahydro-, 2095⁹.
 Phenethyl alcohol, acetate, 2715¹.
 Phenol, 2 ethoxy-5-vinyl-, 1890¹.
 Δ^2 -1-Propenol, 3-*p*-anisyl-, 2164¹.
 Toluic acid, Et ester, P 154¹, 5182².
 3, 5-Xylenol, acetate, 1122¹.
- $C_{10}H_{12}O_2S_2$ Xanthic acid, α -hydroxy-*o*-tolyl ester, 2163⁹.
- $C_{10}H_{12}O_2$ Acetic acid, (2, 6-xylyloxy)-, 2959⁴.
 Acetophenone, 5-ethyl-2, 4-dihydroxy-, 3219⁹.
 Benzaldehyde, 4-ethoxy-3 methoxy-, 3230⁴.
 2-Benzofuran-2-carboxylic acid, 3, 4, 5, 6-tetrahydro-1-methyl-, 2710⁹.
 Butyrophenone, 3, 4-dihydroxy-, 2161⁴.
 Carbonic acid, benzyl Et ester, 124⁹.
 Carbamic acid, Me phenethyl ester, 124⁹.
 Δ^4 - 1, 2 - Cyclohexenedicarboxylic anhydride, dimethyl-, 3674¹, 3692⁹.
 5-*m*-Dioxanol, 2-phenyl(-), 4671².
 1, 3 - Dioxolane - 4 - carbinol, 2 - phenyl(-), 4671².
 Furanacrylic acid, isopropyl ester, 3993⁹.
 propyl ester, 3993⁹.
 Isoxylaldehyde, 4 - hydroxy - 6 - methoxy-, 1894⁴.
 Mandelic acid, α -ethyl-, 3916⁹.
 Rhizomaldehyde, 1894⁴.
- $C_{10}H_{11}O_2S$ Sodium salt - see *Mujman*.
- $C_{10}H_{11}O_4$ (See also *Cantharidin*.)
 Acetophenone, 2 hydroxy-4, 6-dimethoxy-, 1403⁹.
 Acetophenone, 4 - hydroxy - 3, 5 - dimethoxy-, 3452⁹.
 Benzoic acid, 2, 6-dimethoxy-, Me ester, 3453¹.

- 1,2 - Cyclohexanedicarboxylic acid, 3,6-bis(hydroxymethyl)-, dilactone, 3674¹.
 Δ^1 - 1,2 - Cyclohexanedicarboxylic acid, 3-ethylidene, 3674¹.
 Divaric acid, 1632¹.
 Everminic acid, Me ester, 4478¹.
 Homogentisic acid, Et ester, 2706¹.
 Isocantharidin, 3691^{1,2}.
 Phenol, 2,6-dimethoxy-, acetate, 3452¹.
 Rhizonic acid, 1894¹.
C₁₀H₁₅O₅ Acetic acid, (2,3-dimethoxyphenoxy)-, 4481¹.
 Benzoic acid, 3,4,5-trimethoxy-, 1405¹.
 3,4-Furandicarboxylic acid, 2,5-dimethyl-, mono-Et ester, 3926¹.
 Iridic acid, 2180¹.
C₁₀H₁₅O₅ Compd., m. 198° (decomp.), from sorbic acid and maleic anhydride, 3692¹.
 Δ^1 - 1,2,3 - Cyclohexanetricarboxylic acid, 6-methyl-, 3674¹.
C₁₀H₁₅O₅ 1,1,3,3 - Cyclobutanetetracarboxylic acid, 2,2-dimethyl-, and Ag salt, 1398¹.
 1,2,3,4 - Cyclohexanetetracarboxylic acid, 3674¹.
C₁₀H₁₅AsN₂O₅ Phenylthioarsinous acid, di(carbamylmethyl) ester, 3678¹.
C₁₀H₁₅AsN₂O₅ Phenylthioarsinous acid, hydroxy-, di(carbamylmethyl) ester, 3678¹.
C₁₀H₁₅AsN₂O₅ Arsinous acid, (3,5-diacetamido-4-hydroxyphenyl)-, 119¹.
C₁₀H₁₅AsN₂O₅ m-Arsanilic acid, N-acetyl-4-(carbamylmethoxy)-, 841¹.
 Benzenearsonic acid, 3,5-diacetamidohydroxy-, 119¹, 1400¹.
 1,4 - Benzisoxazine - 6 - arsonic acid, 3-hydroxy-8- β -hydroxyethylamino-, 841¹.
C₁₀H₁₅AsN₂O₇ Benzenearsonic acid, 2-acetamido-3-hydroxy-4- α -hydroxyacetamido-, 842¹.
C₁₀H₁₅Br Benzene, 1-bromo-2-*tert*-butyl-, 115¹.
C₁₀H₁₅BrHgO₂ j-Propanol, 3-(bromomercuri)-2-methoxy-3-phenyl-, P 3234¹.
C₁₀H₁₅BrN₂O Acetanilide, 5-bromo-2-dimethylamino-, 117¹.
C₁₀H₁₅BrN₂O₂ See *Nocil*.
C₁₀H₁₅BrN₂O₇ Butylamine, γ -bromo-, picrate, 4669¹.
C₁₀H₁₅BrO₂ Cyclopentanediabetic anhydride, α -bromo- α -methyl-, 110¹.
C₁₀H₁₅BrO₃ 3-*p*-Cymenesulfonic acid, 6-bromo-, Me salt, P 2191¹.
C₁₀H₁₅BrN₂O₂ 2-Pyrrolicarboxylic acid, 4-bromo-5-(bromomethyl)-3-ethyl-, Et ester, 2184¹.
C₁₀H₁₅ClNO₂Sb Carbanilic acid, p -stibono-, γ -chloropropyl ester, 598¹.
C₁₀H₁₅ClN₂O Acetanilide, chlorodimethylamino-, 117¹.
C₁₀H₁₅ClN₂O₂ Xanthine, 8-chloro-3,7-diethyl-1-methyl-, 3903¹.
C₁₀H₁₅ClN₂O₇ Butylamine, β -chloro-, picrate, 4669¹.
C₁₀H₁₅ClN₂O₂ Guanidine, α -(γ -chloro- β -hydroxypropyl)-, picrate, 2177¹.
C₁₀H₁₅ClO Ether, chloromethyl- γ -phenylpropyl, 1871¹.
 Ether, p -chlorophenyl isobutyl-, 823¹.
 Thymol, 6-chloro-, P 1142¹.
C₁₀H₁₅HgNO₂ Aniline, p -(acetoxymercuri)-N,N-dimethyl, 1121¹, 1898¹.
 Aniline, p -(acetoxymercuri)-N-ethyl-, 1121¹.
C₁₀H₁₅HgNO₂ Aniline, N-(acetoxymercuri)-, acetate, 1121¹.
C₁₀H₁₅ Benzene, *tert*-butylisotro-, 115¹.
C₁₀H₁₅N Ethylmethylbenzimidazolium iodide, 1637¹.
C₁₀H₁₅N (See also *Termin.*)
 Aniline, p -isobutenyl-, and -HCl, 4688¹.
 —, p -isopropenyl-N-methyl-, and -HCl, 4688¹.
 Naphthylamine, tetrahydro-, 615¹, P 846¹, P 1143¹, 2172¹, 2488¹, 3739¹, 3751¹, 4270¹, P 4710¹, 5240¹, 5508¹.
 Pyrrolidine, 3-phenyl-, 1634¹.
 Quinaldine, tetrahydro-, 3451¹; and -HCl, 4703¹.
 —, *m*-Toluidine, 4-isopropenyl-, and -HCl, 4688¹.
C₁₀H₁₅NO 2-Butanone, 3-amino-4-phenyl-, 1805¹.
 Formamide, N-methyl-N-phenethyl-, 2980¹, 5177¹.
 Isocarbostyryl, 1,2,3,4-tetrahydro-2-methyl-, 2980¹.
 Propiophenone, 3-amino-4-methyl-, and -HCl, 4457¹.
 —, α -methylamino-, P 613¹.
C₁₀H₁₅NO₂ (See also *Phenacetic*.)
 Alanine, N-benzyl-, 840¹.
 Benzoic acid, p -amino-, 1st ester, 1404¹.
 Benzyl alcohol, α -(α -hydroxaminoethyl)-methylenenitron-, 3689¹.
 Carbanilic acid, N-methyl-, Et ester, 5171¹.
 Formamide, N - (*m*-methoxyphenethyl)-, 5177¹.
 Hydrocinnamic acid, aminomethyl-, 126¹, 4463¹, -HCl, 1892¹, Na salt, P 2988¹.
 —, α -methylamino-, 126¹.
 1-Propanol, 1-phenyl-2-(methylenoximino)-, 4205¹.
 Propiophenone, p -hydroxy- α -methylamino-, P 2723¹.
C₁₀H₁₅NO₂S Acetanilide, 4,5-dimethoxythio-, 3467¹.
 Δ^1 - 2 - Propenesulfonanilide, N-methyl-, 95¹.
C₁₀H₁₅NO₂ Acetanilide, dimethoxy-, 1161¹, 3467¹, 5174¹.
 Benzylidenoxime, propyl-3,4-dihydroxy-, 5162¹.
 Hydrocinnamic acid, 2-amino-5-methoxy-, 126¹.
 Isoserine, N-methyl β -phenyl-, 4684¹.
 2-Pyrrolicarboxylic acid, 4-acetyl-3-ethyl-, methyl-, 2184¹.
 3-Pyrrolicarboxylic acid, 2-formyl-4,5-dimethyl-, 4226¹.
 Rhizonaldehyde, oxime, 1894¹.
C₁₀H₁₅NO Indamide, 2180¹.
C₁₀H₁₅NO₂S Benzoic acid, *m*-(methylsulfonamido)-, Et ester, P 612¹.
C₁₀H₁₅NO₂ Syngic acid, amino-, Me ester, 1405¹.
C₁₀H₁₅NO₂ 1,1,3 - Cyclobutanetricarboxylic acid, 3-carbamyl-2,3-dimethyl-?, and -NH₂ salt, 1398¹.
C₁₀H₁₅N₂O Urea, (1,2,3,4-tetrahydro-1-quinolyl)-, 3442¹.
C₁₀H₁₅N₂O₂ Biuret, 1-ethyl-1-phenyl-, 3442¹.
 Biuret, 1-methyl-1-*p*-tolyl-, 1889¹.
C₁₀H₁₅N₂O₂ Carbamic acid, β -phenylthiocarbonyl-, Et ester, 2953¹.
C₁₀H₁₅N₂O₂ Benzaldehyde, 4-ethoxy-3-hydroxy-, semicarbazone, 1124¹.
 Butyraldehyde, α -hydroxy-, p -nitrophenyl hydrazone, 4670¹.
 Hydrocinnamic acid, α -semicarbazide, 4684¹.
 Isobutyraldehyde, α -hydroxy-, p -nitrophenylhydrazone, 4670¹.

- Isoxylaldehyde, 4, 6-dihydroxy- semicarba-
zone, 1894¹.
- $C_{10}H_{11}N_3O_5S$ *p*-Ethanesulfonophenetide, di-
nitro-, 2704¹.
- $C_{10}H_{12}N_4O_5P$ Inosinic acid, 1646², 3000¹.
- $C_{10}H_{11}N_3O_4$ Adenosine, 853².
- Guaninedesoxypentotide, 2721¹.
- $C_{10}H_{14}$ (See also *Cymene*.)
Benzene, butyl-, 5415¹.
—, *tert*-butyl-, 90¹, 115¹.
4, 6-Decadiene, 2930¹, 2931¹.
Durene, 5469¹.
Isodurene, 5469¹.
Naphthalene, hexahydro, 4466¹.
Prehnitene, 5469¹, 5470¹.
- $C_{10}H_{11}AsNO_3$ Alanine, *N*-(*p*-arsonophenyl), Me
ester, 2954¹.
- $C_{10}H_{11}AsN_2O_5S_2$ Arsine, (*p*-aminophenyl)bis(car-
bamylmethylmercapto)-, P 1649².
Phenylthioarsinous acid, amino-, di(car-
bamylmethyl) ester, 3677¹, 3678¹.
- $C_{10}H_{11}AsN_2O_5S_2$ Arsine, (3-amino-4 hydroxy-
phenyl)bis(carbamylmethylmercapto)-, P
1649².
Phenylthioarsinous acid, 3-amino 4 hydroxy-,
di(carbamylmethyl) ester, 3677¹, 3678¹.
- $C_{10}H_{11}BeO_4$ 2,4-Pentanedione, Be deriv., 2124¹.
- $C_{10}H_{11}BrHgN$ Aniline, *p*-(bromomercuri) *N*, *N*
diethyl-, 1889¹.
- $C_{10}H_{11}BrN$ Amiline, 3 bromo-4 *tert*-butyl-, and
-HCl, 115¹.
Aniline, *p*-bromo-*N*, *N*-diethyl-, 3147¹.
Phenethylamine, *p*-bromo-*N*, α -dimethyl-,
-HBr, 3453¹, 3454¹.
- $C_{10}H_{11}BrNO_2$ 1 - (Carboxymethyl) - 2 - picro-
linium bromide, Et ester, 3022¹.
2 Pyrrolicarboxylic acid, 4-bromo 3-ethyl 5
methyl-, Et ester, 2184¹.
- $C_{10}H_{11}ClN$ Phenethylamine, β -chloro *N*, α di
methyl-, and salts, 3453¹.
- $C_{10}H_{11}Cl_2Sn$ 2,4-Pentanedione, stannic di
chloride deriv., 2424¹.
- $C_{10}H_{11}Cl_2Sn$ Stannane, butyldichlorophenyl,
118¹.
- $C_{10}H_{11}Cl_2N_2Rh + H_2O$, 4217¹.
- $C_{10}H_{11}HgIN$ Aniline, *N*, *N*-diethyl-*p*-(iodomet-
curi)-, 1889¹.
- $C_{10}H_{11}INO$ *p*-Formylphenyltrimethylammonium
iodide, 2429¹.
- $C_{10}H_{11}MoO_3$ Molybdyl bisacetylacetone, 1877¹.
- $C_{10}H_{11}NO_5Sb$ Carbanilic acid, *p*-stibono-, iso-
propyl and Pr esters, 598¹.
- $C_{10}H_{11}N_7$ See *Nicotine*.
- $C_{10}H_{11}N_7O$ (See also *Coramine*.)
Naphthol, (aminoanilino)-, P 2044¹.
Urea, α -phenyl- α -propyl-, 3442¹.
- $C_{10}H_{11}N_3O_4$ Aniline, *tert*-butylnitro-, 115¹, 2952¹.
3 Indazolecarboxylic acid, 2-ethyl-4, 5, 6, 7-
tetrahydro-, 2971¹.
4, 5, 6, 7-tetrahydrodimethyl-, 2972¹.
4, 5, 6, 7-tetrahydro-, Et ester, 2971¹.
3 Isoindazolecarboxylic acid, 1-ethyl-4, 5, 6, 7-
tetrahydro-, 2971¹.
4, 5, 6, 7-tetrahydrodimethyl-, 2972¹.
- $C_{10}H_{11}N_3O_4$ (See also *Allonal*.)
3-Pyrrolicarboxylic acid, 3-formyl-4, 5-di-
methyl-, oxime, 4226¹.
- $C_{10}H_{11}N_3O_4$ Aniline, 4, 5-dimethoxy-*N*, *N*-di-
methyl-2-nitro-, 4204¹.
Aniline, *N*-ethyl-4, 5-dimethoxy-2-nitro-,
4204¹.
- $C_{10}H_{11}N_3O_5S$ *p*-Ethanesulfonophenetide, 2-
nitro-, 2704¹.
- $C_{10}H_{11}N_3O_5$ Norpinic acid, 1,3-dicarbamyl-,
1398¹.
Oxamic acid, *N*, *N'*-vinylenebis-, di-Et
ester, 1639².
- $C_{10}H_{11}N_3S$ Urea, α -methylthio- β -2, 4-xylyl-,
3705¹.
- $C_{10}H_{11}N_3S_2$ Carbazic acid, dithio- β -*m*-tolyl-, Et
ester, 140¹.
Carbazic acid, β -methyl- β -phenyldithio-, Et
ester, 140¹.
- $C_{10}H_{11}N_4O_2$ Theobromine, propyl-, 5165¹.
- $C_{10}H_{11}N_4O_2S_2$ 2,4(3,5)-Thiazoledione, 5-ethyl-,
2,2'-azine, 601¹.
- $C_{10}H_{11}N_4O_3$ Caffeine, α' -ethoxy-, P 612¹.
Uric acid, 3,7-diethyl-1-methyl-, 3903¹.
- $C_{10}H_{11}N_4O_3$ Tetramethylammonium picrate,
3617¹.
- $C_{10}H_{11}N_4S_2$ Acetone, 4-anilinothiosemicarbazone,
140¹.
- $C_{10}H_{11}N_4S_2$ Δ^2 -Thiazoline, 2,2'-(ethylenedi-
amino)bis[5 methylene-, 2177¹.
- $C_{10}H_{11}N_5O_5P$ Adenosinephosphoric acid, 852¹.
Adenylic acid, 853², 1945¹, 2727¹, 3962¹.
- $C_{10}H_{11}N_5O_4$ 2(1) - *s* - Triazone, 1,5 - diacetyl-
tetrahydro - 6 - imino - 3 - methyl - 4 -
(methylcarbamymino)-, 2699¹.
- $C_{10}H_{11}O$ (See also *Carvacrol*; *Carvone*; *Thymol*;
p-*Thymol*.)
2-Butanol, 4-phenyl-, 2171¹.
Cresol, isopropyl, P 1142¹, P 1908¹.
—, propyl-, P 2987¹.
Ether, isopropyl *m*-tolyl-, P 1908¹.
Phenol, *p*-butyl-, 4690¹.
—, *sec*-butyl-, 630¹, 4254¹.
- $C_{10}H_{11}OS$ 1-Butanol, 4-phenylmercapto-, 2423¹.
- $C_{10}H_{11}OS_2$ Anisole, 4-methyl-2,6-bis(methylmer-
capto)-, 825¹.
- $C_{10}H_{11}O_2$ (See also *Camphorquinone*.)
Aldehyde, bp 116–20°, from AcH, 2984².
Methane, methoxyphenethylxy-, 1871¹.
Norcamphane, 2-(hydroxymethylene)-, ace-
tate, 3692¹.
1-Propanol, 3-anisyl-, 4937¹.
Resorcinol, butyl-, 630¹, 1662¹.
—, 4,6-diethyl-, 3219¹.
Spiro[cyclopentane - 1,4' - 1,4 - pyran]
2'(3')-one, 6'-methyl-, 3673¹.
- $C_{10}H_{11}O_3$ Camphoric anhydride, 129¹.
1,1-Cyclopentanedicarboxylic anhydride, α -
methyl-, 110¹.
 Δ^2 - Cyclopentenedicarboxylic acid, 4 - iso-
propyl-2-keto-1-methyl-, 1625¹.
Dicyclopentadienylglycol, ketotetrahydro-,
1623¹.
- $C_{10}H_{11}O_3S$ Cymenesulfonic acid, *Mg* salt, P
2101¹.
- $C_{10}H_{11}O_4$ Acid, m. 178°, from dimethyl ester, m
77.5–8°, 1623¹.
Acid, m. 232°, from ketotetrahydrodicyclo-
pentadiene, 1623¹.
 Δ^1 - 1,2 - Cyclohexenedicarboxylic acid, 4,5-
dimethyl-, 3674¹.
 Δ^2 - 1,6 - Hexadienediol, diacetate, 2696¹.
Spiro[cyclopentane - 1,3'(2') - furan] - 2'-
carboxylic acid, 4',5'-dihydro-5'-keto-2'-
methyl-, and salts, 110¹.
- $C_{10}H_{11}O_5S$ Benzenesulfonic acid, 2-ethoxy-4,5-
dimethoxy-, 3467¹.
- $C_{10}H_{11}O_6$ 1,2,3-Cyclohexanetricarboxylic acid, 1-
methyl-, 3674¹.
1,2 - Cyclopentanedicarboxylic acid, 3 -
acetyl - 4 - hydroxy - 4 - methyl-, 3674¹.
- $C_{10}H_{11}AsN_2O_4$ Arsanilic acid, *N*-(β -carbamy-
ethyl)methyl 5471¹.

- C₁₀H₁₅AsN₄O₅S₂ Phenylthioarsinous acid, 3,5-diamino - 4 - hydroxy-, di(carbamyl-methyl) ester, 3678¹.
- C₁₀H₁₅Br₃N *m*-Bromobenzyltrimethylammonium bromide, 2951¹.
- C₁₀H₁₅Cl Tricyclo[2.2.1.0^{2,5}]heptane, 1-(chloromethyl)-7,7-dimethyl-, 4686⁴.
- C₁₀H₁₅ClN₃O Glycine, *N*-(*N*-trichloroacetyl-leucyl)-, 1389⁴.
- C₁₀H₁₅IS Dimethylphenethylsulfonium iodide, 4670¹.
- C₁₀H₁₅N (See also *Aniline*, *N*, *N*-diethyl-) Cumidine, 3-methyl-, and -HCl, 4688⁴. Cymene, amino-, P 3934⁴. Desoxyephedrine, and -HCl, 3453^{1,2}.
- C₁₀H₁₅NO (See also *Ephedrine*; *Ephelonine*; *Nor-deneine*; *Pseudoephedrine*.) Benzyl alcohol, α -(β -aminoethyl)-*p*-methyl-, and -HCl, 3012⁴. —, α -(dimethylaminomethyl)-, 4269⁴. —, α -(α -methylaminoethyl)-, P 1416⁷. Phenethyl alcohol, β -amino- α , α -dimethyl-, 1892¹. —, β -dimethylamino-, 4269¹. Phenol, *m*-diethylamino-, 1797⁴. —, (α -dimethylaminoethyl)-, and salts, 3451^{1,2}. Pseudoephedrine, 5545⁵. 2-Pyrrolealdehyde, 3,4-diethyl-5-methyl-, 2184⁴.
- C₁₀H₁₅NO₂ 1,1 - Cyclopentanediacetamide, α -methyl-, 110³. Phenethylamine, 2,4-dimethoxy-, 2951⁴. 3-Pyrrolepropionic acid, 4-ethyl-3-methyl-, 1133³.
- C₁₀H₁₅NO₂S Methanesulfonanilide, *N*-propyl-, 2427⁴. Methanesulfonotoluide, *N*-ethyl-, 2427⁴.
- C₁₀H₁₅NO₂ Acetoacetic acid, α -(γ -cyanopropyl)-, Et ester, 834⁴. Ethanol, 2,2'-(hydroxyphenylimino)bis-, P 1143⁴, P 2987⁴, P 3233^{7,7}. —, (salicylimino)bis-, P 2448⁴.
- C₁₀H₁₅NO₂S *p*-Ethanesulfonophenetide, 2704⁷, 4668².
- C₁₀H₁₅NO₂S Pseudoephedrine, acid sulfate, 3454².
- C₉H₁₃N₃S Benzenesulfenamide, *N*, *N*-diethyl-, 4460⁴.
- C₁₀H₁₅N₂O Δ^1 -2-Bicyclo[2.2.1]heptenealdehyde, 3-methyl-, semicarbazone, 3692⁴.
- C₁₀H₁₅N₂O₂ 2(3)-Imidazolone, 4,4'-iminobis[1,3-dimethyl-, 3211⁴.
- C₁₀H₁₅ (See also *Camphene*; *Carene*; *Limonene*; *Nopinene*; *Pinene*; *Terpinene*; *Terpinolene*.) Cyclofenchene, and -HBr, 3694³. Dipentene, 2339³, 2848³, 3207¹. Diprene, 136⁴. Fenchene, 2707⁷, 3693³, 3694². Ocimene, 3803³. Octalin, 4465³, 4944⁴. Phellandrene, 4137⁴. Pinonene, 127^{3,4}. Sabinene, 2166⁴. Sylvestrene, 4137⁴.
- C₁₀H₁₅AsNO₂S₂ Arsine, (*p* - aminophenyl)bis- (β -hydroxyethylmercapto)-, P 1649⁷.
- C₁₀H₁₅Br₃N Benzyltrimethylammonium bromide, 2951¹.
- C₁₀H₁₅BrN₃O Glycine, *N*-[*N*-(α -bromobutyl)glycyl]glycyl-, 2993¹.
- C₁₀H₁₅Br₂N₂S Δ^1 -Thiazoline, 2,2'-(ethylenedimino)bis[6-(bromomethyl)-, 2177⁴.
- C₁₀H₁₅Br₂O Cyclopentanone, dibromo - 5 - methoxy-2,2,3,3-tetramethyl-, 109⁴.
- C₁₀H₁₅Br₂O₂ Adipic acid, α , δ -dibromo-, di-Et ester, 1390³, 2424⁴.
- C₁₀H₁₅ClN₃O Glycine, *N*-[*N*-(*N*- β -chlorobutylglycyl)glycyl]-, 1389³.
- C₁₀H₁₅Cl₂ Necamphane, 2 - chloro - 1 - (chloromethyl)-7,7-dimethyl-, 4686⁴.
- C₁₀H₁₅Cl₂S, 1524⁴.
- C₁₀H₁₅ClN₂O₂ 2,5 - Piperazinedione, 1,4 - dimethyl-, compd. with chloral hydrate, 141².
- C₁₀H₁₅FeN₂O₂ Addn. compound of H₂Fe(CN)₄ and C₂H₅OH, 3638⁷.
- C₁₀H₁₅IN Indole, 4,5,6,7-tetrahydro-2-methyl-, methiodide, 1635⁴. 1-Isoamylpyridinium iodide, 1902¹.
- C₁₀H₁₅INO (α -Hydroxy-*p*-tolyl)trimethylammonium iodide, 124¹.
- C₁₀H₁₅N₂ Hydrazine, carvacryl-, and salts, 5470³. Hydrazine, α , β - dimethyl - α - (2,5 - xylyl) , 4699⁷. Indazole, 4,5,6,7 tetrahydro 2,4,6 - tri-methyl-, 2972⁴. Isoindazole, 1 - ethyl - 4,5,6,7-tetrahydro-7-methyl-, 2972⁴. —, 4,5,6,7 - tetrahydro - 1,4,6 - trimethyl , 2972². *p*-Phenylenediamine, *N*, *N*-diethyl-, HCl and ZnCl₂ salt, P 2722². Pyrazole, 1 - allyl - 4 - ethyl - 3,5 - dimethyl -, 4701¹.
- C₁₀H₁₅N₂O Camphidone, imino-, P 607⁴; and HCl, 2980⁴.
- C₁₀H₁₅N₂O Neonol, 9114, P 4950⁷.
- C₁₀H₁₅N₂O₂ Barbituric acid, 5-ethyl-5 propoxy methyl-, 4744⁴.
- C₁₀H₁₅N₂O₂ Anserine, 4233³, 4481³.
- C₁₀H₁₅O (See also *Camphor*; *Citral*; *Hexelone*. *Isopulegone*; *Pulegone*.) Carvone, dihydro-, 1745⁴. Cyclohexenealdehyde, trimethyl-, 3692⁴. Linalool, dehydro , 5465³. 3-*p*-Menthadienol, 2167⁴. Naphthalene, 4a,8a-epoxy-1,2,3,4,5,6,7,8 octahydro-, 4466¹. Pinene, oxide, 4463¹. Pinocarveol, 2432⁴. 2-Propanone, 1- Δ^1 -cycloheptenyl-, 4678⁴. —, 1-cycloheptylidene-, 4678⁴. Sabinol, 2432⁴. Thujone, 2247⁷, 4137⁴. 1 - Tricyclo[2.2.1.0^{2,5}]heptanecarbinol, 7,7-dimethyl-, 4686⁴.
- C₁₀H₁₅OS Dimethylphenethylsulfonium hydroxide, 4670¹.
- C₁₀H₁₅OS₂ 2-Norcamphanemethylxanthic acid, *S*-methyl ester, 3692².
- C₁₀H₁₅O₂ (See also *Ascaridole*.) Acid, m. 98⁴, from crotonic acid and methyl pentadiene, 3692⁷. Camphor, hydroxy-, 3693³. Compd. from nopinene and O₂, 2167¹. Δ^1 - α -Cyclohexanecacetic acid, Et ester, 4454³. Δ^1 -Cyclohexenecacetic acid, Et ester, 4454¹. Cyclopentanecarboxylic acid, 4 - acetyl - 2,2 - dimethyl-, 3694¹. α -Fenchenylic acid, 3693³. Δ^1 , Δ^1 -Hexadienol, 2,5-dimethyl-, acetate, 2696⁴. 2-Norcamphanecarbinol, acetate, 3692¹.
- C₁₀H₁₅O₂ Cyclohexanecarboxylic acid, 2-keto-1-methyl-, Et ester, 383⁴.

- Cyclopentaneacetic acid, 1-acetyl-, 3673¹.
 —, 1-acetyl-, Me ester, 110⁴.
 Cyclopentanecarboxylic acid, 4-acetyl-2,2-dimethyl-, and salts, 3694¹.
 —, 1-ethyl-2-keto-, Et ester, 109⁷.
 —, 4-isopropyl-2-keto-1-methyl-, 1625².
 Nopinene, ozonide, 829⁹, 4464⁸.
 Pinonic acid, 2167¹, 5178⁷.
C₁₀H₁₆O₂S Camphane - ω - sulfonic acid, 2 - hydroxy-, lactone, 3456⁸.
C₁₀H₁₆O₄ 1,2-Cyclohexanediadicetic acid, P 2989¹.
 1,4-Cyclohexanedicarboxylic acid, di-Me ester, P 154¹, P 2986¹.
 1,3-Cyclohexanediol, diacetate, 4677².
 Cyclohexanepropionic acid, 2 carboxy-, P 2989¹.
 1,1-Cyclopentanediadicetic acid, α -methyl-, and Ag salt, 110³.
 Dicyclopentadienediglycol, tetrahydro-, 1623².
 Glutaric acid, α -hydroxy- β -isopropyl-, γ -lactone, Et ester, 3668⁸.
 Hexenediol, diacetate, 2896¹.
C₁₀H₁₆O₃ Hexane - 1,4,5,6 - tetrol < 1,5 > anhydride, diacetyl-, 3671¹.
C₁₀H₁₆O₄ *p*-Dioxanedicarbinol, diacetate, 2697⁷.
 1-Propanol, 1,3-epoxy, acetate, dimer, 4929⁸.
C₁₀H₁₆O₇ Volemitol, triformylacetal, 4192¹.
C₁₀H₁₆O₈ Diarabinosan, 2425⁷.
C₁₀H₁₆S Thiophene, diethyldimethyl-, 502¹.
C₁₀H₁₇BrN₂ 4,5,6,7-Tetrahydro-1,2,5-trimethylindazolium bromide, 2972⁸.
C₁₀H₁₇BrN₂O₄ Glycine, *N* - [*N* - (α - bromoisocaproyl)glycyl] -, 4192⁸.
 Glycine, *N* - [*N* - (α -bromopropionyl)valyl] -, 1112¹.
C₁₀H₁₇Cl Camphane, 2 chloro-, P 4485⁵.
 Naphthalene, chlorodecahydro-, 1407⁴.
C₁₀H₁₇ClN₂O₄ Glycine, *N* - (*N* - chloroacetyl-leucyl) -, 1113⁸.
 Leucine, *N* - (*N*-chloroacetyl-glycyl) -, 4232⁸.
C₁₀H₁₇IN₂ Isopyrazole, 3,4,4,5-tetramethyl, allyl iodide deriv., 4700⁸.
 4,5,6,7 - Tetrahydrotrimethylindazolium iodide, 2972⁸.
C₁₀H₁₇N γ -Pentenonitrile, α -ethyl- α -isopropyl-, P 2987¹.
C₁₀H₁₇NO 2(3)-Pyrrolone, 5-amyl-1-methyl-, 4469⁸.
C₁₀H₁₇NO₂S Acetic acid, thiocyanato-, heptyl ester, 4930⁸.
C₁₀H₁₇NO₃ Valine, *N* - β , β - dimethylacrylyl-, 2993¹.
C₁₀H₁₇NO₃S 3-Camphorsulfonamide, 1887⁵.
C₁₀H₁₇NO₄ Lobelinic acid, and Am salt, 4706⁸.
C₁₀H₁₇NO₅ Aspartic acid, *N*-acetyl-, di-Et ester, 5161⁸.
C₁₀H₁₇N₂O 2 - Butanone, 1 - Δ^1 - cyclopentenyl, semicarbazone, 2946⁷.
 2-Butanone, 1-cyclopentylidene-, semicarbazone, 2946⁷.
 Cyclohexenealdehyde, dimethyl-, semicarbazone, 3692⁸.
 β -Fenchocamphorone, semicarbazone, 3693⁸.
 Nopinone, semicarbazone, 2167¹.
 Sabinaketone, semicarbazone, 2167².
 Semicarbazone, m. 209⁹, of ketone from ozonide of β -fenchene, 3694⁸.
 Tanacetophorone, δ -methyl-, semicarbazone, 1625².
C₁₀H₁₇N₂O₂ Cyclopentaneacetic acid, 1-acetyl-, semicarbazone, 110⁴.
C₁₀H₁₇N₂O₃ Glycine, *N* - [*N* - (*N*-butyryl-glycyl)glycyl] -, 2992¹.
 Malonic acid, (γ -keto- α , α -dimethylbutyl)-, semicarbazone, 2153¹.
C₁₀H₁₈ (See also *Decalin*; *Menthene*.)
 Cyclohexane, 1,1,2-trimethyl-3-methylene-, 4453².
 Cyclopentane, 1,2,2 - trimethyl - 3 - vinyl -, 1405⁸.
 Cyclopentene, isoamyl-, 4453⁸.
 Dihydroterpene from *Ptilosporum pentlandrum*, 5546².
 Octadiene, dimethyl-, 2848⁸.
C₁₀H₁₈AsN Arsine, cyanocyclohexylpropyl -, 121¹.
C₁₀H₁₈BrNO₂ Norvalin *N*-(α -bromovaleryl)-, 2993².
 Valine, *N*-(α -bromoisovaleryl)-, 2993².
C₁₀H₁₈CINO₂ Leucine, *N* - β - chlorobutyryl -, 1389¹.
C₁₀H₁₈CINO₂ 2-Octanol, 1-chloro-1-nitro-, acetate, 372⁸.
C₁₀H₁₈IN Indole, 2,3,4,5,6,7 - hexahydro - 2 - methyl-, methiodide, 1635².
C₁₀H₁₈N₂ Pyrazole, 4 - ethyl - 3,5 - dimethyl - 1 - propyl-, 4701¹.
 Pyrazole, 4 - ethyl - 1 - isopropyl - 3,5 - dimethyl-, 4701¹.
C₁₀H₁₈N₂O₂ Δ^5 - 2 - lleptenol, 6 - methyl-, allophanate, 4187⁸.
C₁₀H₁₈N₂O₃ Butyric acid, β (α carbomethoxyacetamidol)-, Et ester, 1618⁷.
 Glycine, *N*-(β -carbomethoxyaminobutyryl)-, Et ester, 1618⁷.
C₁₀H₁₈N₂O₃S₂ Δ^2 -Thiazoline, 2,2'-(ethylenedi-imino)bis[5 (hydroxymethyl)-], 2177⁸.
C₁₀H₁₈N₂O₄ Glycine, *N* - [*N* - (*N*-aminobutyryl)glycyl]glycyl] -, 1389², 2993¹.
 Glycine, glycylglycylglycyl-, ethyl ester, 1429¹.
C₁₀H₁₈N₂S₂ Urea, α , α' -ethylenebis[β -allylthio-, 2177⁸.
C₁₀H₁₈O (See also *Borneol*; *Meole*; *Citronellal*; *Geraniol*; *Isoborneol*; *Linalool*; *Menthone*; *Terpinol*.)
 Carveol, dihydro-, 128⁸.
 6-Carvomenthenol, 4464¹.
 Cyclohexanone, 4-butyl-, 4690¹.
 —, 2,2,6,6 tetramethyl-, 2702⁸.
 Cyclopentanone, 2-butyl-5-methyl-, 2702⁸.
 —, 2-isobutyl-5-methyl-, 2702⁸.
 Ether, bis(α -methyl- Δ^2 -butenyl), 4196⁷.
 Fenchyl alcohol, 90⁸, 2338⁸.
 Ketone, b.p. 104-6⁹, from compd. b.p. 128⁹, 4689⁸.
 Δ^1 -4-*p*-Menthenol, 128⁸.
 1-(4)-Naphthol, octahydro-, 4465⁹, 4944⁸.
 Nerol, 5272².
 β -Octenaldehyde, β , δ -dimethyl-, 1614⁷.
 1-Octen-3-ol, 3,7-dimethyl-, 1614².
 Rhodinal, 95⁸.
C₁₀H₁₈O₂ Carvomenthol, 1,6-epoxy-, 4464².
 Cyclohexaneacetic acid, Et ester, P 154¹, P 2986¹.
 Cyclohexanebutyric acid, P 848⁸.
 1,2 - Cyclohexanediol, 1 - methyl-, acetone compd., 2701⁸.
 2,4-Decanedione, 3685⁷.
 Rnathaldehyde, β isopropyl- α -keto-, 4207¹.
 3,4 - Hexanedione, 2,2,5,5 - tetramethyl -, 2936¹.
 Isocampholic acid, 1405⁷.
 1-Norcamphanecarbinol, 2-hydroxy-7,7-dimethyl-, 4686⁷.
 β -Pentenic acid, α , α , β -trimethyl-, Et ester, 110².

- C₁₀H₁₈O₃** Capric acid, γ -keto-, 4469⁹.
 Caproic acid, δ -keto- β , β -dimethyl-, Et ester, 2153².
 Caprylic acid, ϵ -keto- β , γ -dimethyl-, 2156¹.
 Cyclobutanecarboxylic acid, 3-amoxy-, and Ag salt, 2700⁹.
 Enanthic acid, β -isopropyl- ϵ -keto-, 4207¹.
 Levulinic acid, α , β , β -trimethyl-, Et ester, 110⁹.
C₁₀H₁₈O₄ Caprylic acid, η -hydroxy-, acetate, 3663².
 2-*m*-Dioxane ϵ thanol, α , 4-dimethyl-, acetate, 4930¹.
 1, 3 - Dioxolane, 2, 2' - (1, 4 - butylene)bis-, 2937⁹.
 Sebacic acid, 3138⁹.
C₁₀H₁₈O₅ Camphane - ω - sulfonic acid, 2 - hydroxy-, and salts, 3459⁹.
C₁₀H₁₈O₆ Malonic acid, (α -hydroxyethyl)methyl-, di-Et ester, 4447⁷.
C₁₀H₁₈O₇ Galactoside, 3, 4 - isopropylidene - β - methyl-, 3669⁹.
 Gluconolactone, tetramethyl-, 2423^{1, 2}.
 Glucose, monoacetone-3-methyl-, 107³.
 Glucoside, monoacetone- γ -methyl-, 102⁷.
 Mannonolactone, tetramethyl-, 2423^{1, 2}.
 Tartaric acid, di-Pr and diisopropyl esters, 4448^{1, 2}.
C₁₀H₁₈O₇ Glutaric acid, α , β , γ -trimethoxy-, di-Me ester, 1881⁹.
C₁₀H₁₈Br Cyclopentane, 1-(β -bromoethyl)-2, 2, 3-trimethyl-, 1405⁹.
C₁₀H₁₈Cl Cyclopentane, 1-(β -chloroethyl)-2, 2, 3-trimethyl-, 4686².
C₁₀H₁₈I Cyclopentane, 1-(β -iodoethyl)-2, 2, 3-trimethyl-, 4686².
C₁₀H₁₈IN₂ Isopyrazole, 4, 4 - diethyl - 3, 5 - dimethyl-, methiodide, 4700⁹.
 Isopyrazole, 3, 4, 4, 5-tetramethyl-, isopropyl iodide deriv., 4700⁹; PrI deriv., 4700⁹.
C₁₀H₁₈N Norcamphane, 2 - (dimethylamino-methyl)-, 3692⁹.
C₁₀H₁₈NO (See also *Lupinine*.)
 2-Butanone, 4-4³ methyl-1-piperidyl-, -HCl, 802¹.
 Menthone, oxime, 2155⁹.
 β - Octenaldehyde, β , γ - dimethyl -, oxime, 1614².
 4-Piperidone β 1-isomyl-, -HCl, 1902⁹.
C₁₀H₁₈NO₂ Homolevulinamide, *N*, *N*-diethyl-, 4190⁹.
 1-Piperidinepropionic acid, Et ester, 1390².
 Propionic acid, β -piperidyl-, Et ester, 3207².
C₁₀H₁₈NO₂ Leucine, *N*-acetyl-, Et ester, 5161⁹.
C₁₀H₁₈NO₂ 2-Octanol, 1-nitro-, acetate, 372⁹.
C₁₀H₁₈N₂O₅b Benzenesulfonic acid, β -amino-, diethylammonium salt, 4718².
C₁₀H₁₈N₂O Cycloheptanone, 2, 2-dimethyl-, semicarbazone, 2702⁹.
 Cyclopentanone, 4-isopropyl-2-methyl-, semicarbazone, 1625².
 Norisocamphoraldehyde, semicarbazone, 1405⁹.
C₁₀H₁₈N₂O₄ Asparagine, leucyl-, 2730⁹.
 Glycine, *N*-(*N*-alaninylvalyl)-, 1112¹.
 —, glycylleucyl-, 89⁹, 1118⁹.
 —, *N*-(*N*-leucylglycyl)-, 2992⁹, 4192⁹.
 Leucine, *N*-(*N*-glycylglycyl)-, 4232⁹.
C₁₀H₁₈ Cyclopentane, isomyl-, 4453².
 1-Decene, 3207¹.
 Diamylene, 1384⁷, 2561⁷, 2813⁷, 3337⁷, 3903¹.
 Octene, dimethyl-, 2934⁹, 4441⁷, 5466^{2, 3}.
C₁₀H₁₈BrNO 3-Carboxy-1-ethyl-1-methylpiperidinium bromide, Me ester, 3022⁹.
C₁₀H₁₈Br₂Te Telluropyran, bromo(bromoamyl)-tetrahydro-, 1787².
C₁₀H₁₈Cl₂Te Telluropyran, chloro(chloroamyl)-tetrahydro-, 1787².
C₁₀H₁₈IN Indole, octahydro - 2 - methyl -, methiodide, 144².
C₁₀H₁₈INO₂ 1-(Carboxymethyl)-1-methylpiperidinium iodide, Et ester, 3022⁹.
 1 - β - Hydroxyethyl - 1 - methylpiperidinium iodide, acetate, 3022⁹.
C₁₀H₁₈I₂Te Telluropyran, tetrahydroiodo(iodoamyl)-, 1787².
C₁₀H₁₈N₂ Quinoline, 2-aminodecahydro-3-methyl-(?), and -HCl, 132².
C₁₀H₁₈N₂O₂ Leucine, *N*-(β -aminobutyl)-, 1889¹.
 Norvaline, *N*-(α -aminovaleryl)-, 2993⁹.
 Valine, *N*-valyl-, 2993⁹.
C₁₀H₁₈N₂O Suberic acid, α , γ -diamino-, di-Me ester, di-HCl, 1621².
C₁₀H₁₈N₂O₂ Glutaramide, α , β , γ - trimethoxy - *N*, *N'*-dimethyl-, 1881⁹.
C₁₀H₁₈N₂S₂ Disulfide, bis(diethylthiocarbamyl)-, 1307².
C₁₀H₁₈N₂O Isopelletierine, *N*-methyl-, semicarbazone, -HCl, 1132².
C₁₀H₁₈N₂O Semicarbazone, decomps. 190⁹, of compd. from camphorone and NH₂OH, 4200⁹.
C₁₀H₁₈O (See also *Citronellol*; *Isomenthol*; *Menthol*.)
 Caprylaldehyde, β , γ -dimethyl-, 1614², 5467¹.
 Carvomenthol, 4464¹.
 Compd., *b_m* 128⁹, from *p*-isobutenylphenol, 4689⁹.
 Cyclohexanol, 4-butyl-, 4690¹.
 —, 2-isopropyl-4-methyl-, P 1142⁹.
 Cyclopentanecethanol, 2, 2, 3 - trimethyl -, 1405⁹.
 Cyclopentanol, 2-ethyl-1-propyl-, 109².
 —, isomyl-, 4453².
 5-Decin-4-one, 2931².
 Ether, butyl cyclohexyl, 3674¹.
 —, cyclohexyl isobutyl, 3674¹.
 —, Δ^1 -heptenyl propyl, 2416⁹.
 Furan, 2, 2, 5-triethyldihydro-, 4190⁷.
 4-Octanone, 5, 5-dimethyl-, 1615².
 Rhodinol, 1993⁹, 4137⁹, 4620⁹.
C₁₀H₁₈O₂ (See also *Capric acid*; *Terpinol*.)
 Butyric acid, α , α -dimethyl-, Bu ester, 3438⁹.
 Citronellol, hydroxy-, 2696⁹.
 Cyclohexanecarbinol, α - (ethoxymethyl) -, 113².
 —
m-Dioxane, 2, 2-dipropyl-, 4671¹.
 —, 4-ethyl-2-isopropyl-5-methyl-, 1615².
 1, 3-Dioxolane, 2-isopropyl-4, 4, 5, 5-tetra-methyl-, 1615².
 1-Hexanol, 2, 3-dimethyl-, acetate, 125⁴.
 3-Hexanone, 4-hydroxy 2, 2, 5, 5-tetramethyl-, 2936⁹.
C₁₀H₁₈O₂ Capric acid, ϵ -hydroxy-, 1389².
 8-*m*-Dioxanol, 2, 2-dipropyl-(?), 4671¹.
 1, 3-Dioxolane-4-carbinol, 2, 2-dipropyl -, 4671¹.
 Pelargonic acid, δ -hydroxy-, Me ester, 1388², 3663².
 Valeric acid, β -hydroxy- α , α , β -trimethyl-, Et ester, 110⁹.
C₁₀H₁₈O₂ Fructose, tetramethyl-, 4451².
 Glucose, tetramethyl-, 1339².
C₁₀H₁₈Br Octane, 1-bromo-3, 7-dimethyl-, 4411².
C₁₀H₁₈Cl₂ Octane, 1-chloro-3, 7-dimethyl-, 4686².
C₁₀H₁₈ClIN₂ Trimethyl(1 - piperidyl)carbamylmethylanionium chloride, 3023².
C₁₀H₁₈I Octane, 1-iodo-3, 7-dimethyl-, 4686².

- C₁₀H₁₇N Cyclohexylamine, *N*-sec-butyl-, and -HCl, 111¹.
 Cyclopentanethylamine, 2,2,3-trimethyl-, and -HCl, 4686².
 C₁₀H₁₇NO Caprylaldehyde, β,γ-dimethyl-, oxime, 1614¹.
 2-Piperidineethanol, 1-propyl-, 1902².
 Valeramide, *N*, *N*-diethyl-β-methyl-, 2697³.
 C₁₀H₁₅N₃O Biuret, 1,1-dibutyl-, 3442⁴.
 C₁₀H₁₅P₂ Phosphine, tripropyl-, CS₂ compd., 4441⁵.
 C₁₀H₁₈ (See also *Decane*.)
 Octane, dimethyl-, 2421¹, 3659¹.
 C₁₀H₁₅AsCl Arsine, chlorodisoamyl-, 120⁷.
 C₁₀H₁₅ClNO₂ Triethylamine, β - [β - (β-chloroethoxy)ethoxy]-, P 241¹.
 C₁₀H₁₅Cl₄N₂O₂Pt₂, 1582².
 C₁₀H₁₅Cl₄N₂O₂Pt₂, 1582².
 C₁₀H₁₅HgO₂S Pentane, 1-(hydroxymercuri)-, sulfate, 1871¹.
 C₁₀H₁₅N₂O₂ Propionaldehyde, β-diethylamino-, semicarbazone, acetate, 3209³.
 C₁₀H₁₇O Decyl alcohol, 4142¹, 5074¹.
 3-Heptanol, 2,2,3-trimethyl-, 2420¹.
 Isoamyl ether, 4616¹.
 1-Octanol, 8,7-dimethyl-, 4441¹.
 3-Pentanol, 2,2,3,4,4-pentamethyl-, 2420¹.
 C₁₀H₁₇O₂ Acetaldehyde, diisobutyl acetal, P 608¹.
 4,5-Octanediol, 4,5-dimethyl-, 1615¹.
 C₁₀H₁₇O₂S Sulfone, ethyl octyl, 2419¹.
 C₁₀H₁₇S Amyl sulfide, 4440¹.
 Decyl mercaptan, 4669¹.
 Isoamyl sulfide, *HgCl* compds., 4925¹.
 C₁₀H₁₇Se Decyl selenomercaptan, 4670¹.
 C₁₀H₁₇Zn Zinc isoamyl, 1366¹.
 C₁₀H₁₇N Dipropylamine, α,α'-diethyl-, and -HCl, 112¹.
 Octylamine, γ,γ-dimethyl-, and -HCl, 4686².
 C₁₀H₁₇N₂ Guanidine, α,α-diethylisoamyl-, P 5194¹.
 C₁₀H₁₇IN Diethyldipropylammonium iodide, 1638¹.
 C₁₀H₁₇IP Methyltripropylphosphonium iodide, 4441¹.
 C₁₀H₁₇K₂N₂IO₂ + 3H₂O, 1361¹.
 C₁₀H₁₇N₂ 1,10-Decanediamine, di-HCl, 4932¹.
 C₁₀H₁₇N₂ Guanidine, octamethylenebis-, 1115¹, 2425¹.
 C₁₀H₁₇N₃ Biguanide, α,α'-hexamethylenebis-, hydrogen sulfate, 4932¹.
 C₁₀H₁₇N₂P₂S₄, 3668¹.
 C₁₀H₁₇NO Heptyltrimethylammonium hydroxide, 2419¹.
 C₁₀H₁₇N₂ Diethylamine, β-diethylamino-β'-dimethylamino-, P 1416¹.
 C₁₀H₁₇N₂ Guanidine, α-(β-guanidobutyl)-α-(γ-guanidopropyl)-(?), P 154¹.
 C₁₀H₁₇Cl₄N₂Sn Trimethylthylammonium chlorostannate, 3139¹.
 C₁₀H₁₇N₂IO₂ + 3H₂O, 2384¹.
 C₁₀H₁₇Sn₂ Stannobutane, decamethyl-, 4670¹.
 C₁₀H₁₇BrLi₂ Addn. compd. from LiBr and Me₂NH, 2119¹.
 C₁₀H₁₇ILi₂ Addn. compd. from LiI and Me₂NH, 2119¹.
 C₁₀N₂O₂Sc₂ + 9H₂O Scandium sodium oxalate, 3180¹.
 C₁₀H₁₇BrNO₂ 2,4-Quinolinedicarboxylic acid, 6,8-dibromo-, P 4981¹.
 C₁₁H₁₃O₂S 2,3-β-Naphthothiazolodione, P 4950¹.
 C₁₁H₉ClNO Naphthostyryl, chloro-, P 2190¹, P 2728¹.
 C₁₁H₉Cl₂O₂ Coumarin, 3-acetyl-6,8-dichloro-5-hydroxy-, 3219¹.
 C₁₁H₉HgO₂ 1-Naphthoic acid, 8-(hydroxymercuri)-, 1,8-anhydride, 3463¹.
 C₁₁H₉HgO₂ Anhydro-4-hydroxymercuri-3-hydroxy-2-naphthoic acid, 3924¹.
 C₁₁H₉ClO₂ Umbelliferone, 3-acetyl-6-chloro-, 3219¹.
 C₁₁H₉HgNO₂ 1-Naphthoic acid, 8-(hydroxymercuri)-3-nitro-, *Na* salt, 3463¹.
 C₁₁H₉N 2-Naphthonitrile, 3924¹.
 C₁₁H₉NO Naphthonitrile, hydroxy-, P 2190¹.
 Naphthostyryl, P 1650².
 C₁₁H₉NO₂S Naphthalenesulfonic acid, cyano-, 288².
 C₁₁H₉NO₂ 1-Naphthoic acid, nitro-, 3463¹.
 C₁₁H₉NO₂ Umbelliferone, 3-acetyl-8-nitro-, 3219¹.
 C₁₁H₉N₂O₂ Pyrazolecarboxylic acid, nitrobenzoyl-, 1637¹.
 C₁₁H₉ 1,3-Pentadiene, 1-phenyl-, 2695¹.
 C₁₁H₉Br₂N₂O 2-Furaldehyde, (dibromophenyl)-hydrazone, 1400¹.
 C₁₁H₉HgO₂ 1-Naphthoic acid, 8-(hydroxymercuri)-, *Na* salt, 3463¹.
 C₁₁H₉N₂O₂ 1-Naphthamide, nitro-, 3463¹.
 3-Quinolincarboxylic acid, 2-carbamyl-, 839¹.
 C₁₁H₉N₂O₂ 4,5-Imidazolecarboxylic acid, 2-phenyl-, 1339¹.
 C₁₁H₉N₂O₂ 5-Quinolincarboxylic acid, 6(?) 8(?)-dinitro-, *Me* ester, 1904¹.
 C₁₁H₉O₂ (See also *Naphthoic acid*)
 1-Naphthaldehyde, 2-hydroxy-, P 2446¹.
 C₁₁H₉O₂ 1-Naphthaldehyde, dihydroxy-, P 2446¹, P 2447¹.
 Naphthoic acid, hydroxy-, P 2190¹, 2435¹, 3220¹, 3924¹, P 4713¹; *salts*, P 1420¹, 3462¹, 3463¹; *Na* salt, 4973¹.
 C₁₁H₉O₂ Furanacrylic acid, furyl ester, 3993¹.
 Naphthoic acid, dihydroxy-, P 2190¹, P 4349¹.
 Umbelliferone, 3-acetyl-, 829¹.
 C₁₁H₉O₂ Coumarin, 3-acetyl-7,8-dihydroxy-, 829¹.
 C₁₁H₉O₂S Naphthoic acid, hydroxysulfo-, P 609¹, P 2190¹, P 2988¹; and *di-Na* salts, P 1139¹.
 C₁₁H₉O₂ Hemimellitic acid, 4,5-dimethoxy-, ahydride, 4223¹.
 C₁₁H₉O₂S₂ 2-Naphthoic acid, 6-hydroxy-7,8-disulfo-, P 609¹.
 C₁₁H₉S₂ 1-Naphthoic acid, dithio-, 4939¹.
 C₁₁H₉AgBrNO Ketone, bromomethyl-2-methyl-3-indyl, *Ag* deriv., 4216¹.
 C₁₁H₉AgClNO Ketone, chloromethyl-2-methyl-3-indyl, *Ag* deriv., 4215¹.
 C₁₁H₉AgN₂O Malonamic acid, α-cyano-, benzyl ester, *Ag* deriv., 4193¹.
 Malonanilic acid, α-cyano-, *Me* ester, *Ag* deriv., 4193¹.
 C₁₁H₉BrO Ether, 3-bromo-2-naphthyl methyl, 833¹.
 C₁₁H₉Cl Naphthalene, 1-chloro-2-methyl-, P 613¹.
 C₁₁H₉ClN₂O Cinchoninamide, 2-chloro-*N*-methyl-, P 1217¹.
 C₁₁H₉ClO₂ *m*-Coumaryl chloride, methylcarbonate, 4211¹.
 C₁₁H₉IO Ether, 8-iodo-2-naphthyl methyl, 833¹.
 C₁₁H₉N Pyridine, phenyl-, 5185¹.
 C₁₁H₉NO Compd., m. 100-1°, from compd., m. 141°, 4218¹.
 Ketone, phenyl pyrryl, 3978¹.

- C₁₁H₉NO₂ (See also *Naphthoic acid, amino*.)
 Crotonic acid, α -benzalamino- β -hydroxy-, lactone, 1120¹.
 Isoquinoline, 1-methyl-6,7-methylenedioxy-, 2444².
 2-Naphthamide, 6-hydroxy-, P 2188⁴.
 C₁₁H₉NO₂ Kynurenic acid, methyl-, 138⁸.
 1,2(2) - Quinolinedicarboxylic anhydride, 3,4-dihydro-, 1411⁸.
 2,3-Quinolinediol, 3-acetate, 2443¹.
 C₁₁H₉NO₂S Cinchoninic acid, 1,2-dihydro-2-keto-3-mercapto-1-methyl-, 2443⁷.
 C₁₁H₉NO₂ 3-Indoleacetic acid, 2-carboxy-, 834¹.
 Propionic acid, *o*-nitrophenyl-, Et ester, 1636¹.
 C₁₁H₉NO₂S Salicylic acid, Me ester, thiocyanate, 4930⁸.
 C₁₁H₉NO₂ Quinolincarcabamic acid, nitro-, Me ester, 1904¹, 3227⁸.
 C₁₁H₉N₂O₂ Benzisoxazole, 2-diacetyl-amino-5-nitro-, 2973⁸.
 1,2,4-Oxiazole, 5-methyl-3-(4-nitrosalicyl)-, acetate, 2973⁸.
 C₁₁H₉ Naphthalene, methyl-, P 920⁸, 1896⁸, 3697⁸.
 C₁₁H₉AgNO₂ Ketone, hydroxymethyl 2-methyl-3-indyl, Ag deriv., 3928¹.
 C₁₁H₉BrNO Ketone, bromomethyl 2-methyl-3-indyl, 4216¹.
 C₁₁H₉Br₂ClNO₂ Tyrosine, 3,5-dibromo-*N*-chloroacetyl-, 2993⁸.
 C₁₁H₉Br₂O₂ 4-Chromanone, 3,3-dibromo-2,2-dimethyl-, 1901³.
 C₁₁H₉ClNO Ketone, chloromethyl 2-methyl-3-indyl, 3927¹, 4215⁸.
 C₁₁H₉ClNO₂ Hydrocinnamic acid, 5-chloro-2-cyano- β -methyl-, 126⁸.
 C₁₁H₉Cl₂NO₂ Tyrosine, 3,5-dichloro-*N*-chloroacetyl-, 2993⁸.
 C₁₁H₉Cl₂O₂S 1,3-Benzodioxan-6-sulfonic acid, 2,4-bis(dichloromethyl)-, Me ester, 2975⁷.
 C₁₁H₉FeI₂N₂O₂ 353⁴.
 C₁₁H₉I₂NO Ketone, iodomethyl 2-methyl-3-indyl, 4216².
 C₁₁H₉MoNO₂, 2588⁸.
 C₁₁H₉NNaO₂S 1,2-Naphthoquinone, 1-oxime, Me ether, NaHSO₃ compd., 2434⁴.
 C₁₁H₉N₂O Oxime, m. 206-7°, of compd. m. 100-1°, 4218⁷.
 2,9-Pyridindiol-1(2)-one, 3,4-dihydro-, 834⁷.
 C₁₁H₉N₂O₂ Naphthylamine, *N*-methylnitro-, 4466⁸.
 Oxazole, 2-acetamido-4-phenyl-, 2177⁸.
 1,3,4,6-Oxdiarin-5(4)-one, 2-styryl-, 2977¹.
 Pyrazolecarboxylic acid, methylphenyl-, 3704¹.
 Quinolincarcabamic acid, Me ester, 1903⁸, 3228¹.
 3-Quinolincarcaboxylic acid, 2-amino-, Me ester, 839⁷.
 C₁₁H₉N₂O₂ Malonanilic acid, α -cyano-, Me ester, 4193⁴.
 C₁₁H₉N₂O₂ Biuret, 1-(8-quinoly)-, 3228².
 C₁₁H₉N₂O₂ Creatinine, 5-*m*-nitrobenzal-, 5469¹.
 C₁₁H₉O Ether, methyl 2-naphthyl, 2161¹.
 α , γ -Pentadienaldehyde, 6-phenyl-, 3687⁸.
 C₁₁H₉O₂ Coumarin, dimethyl-, P 1418⁴.
 2-Naphthoic acid, dihydro-, 2172⁸.
 C₁₁H₉O₂S Naphthalenesulfonic acid, Me ester, 2160².
 Thiochromone, hydroxymethoxymethyl-, 2441¹.
 Thionaphthalenealdehyde, ethoxyhydroxy-, P 2447¹.
- C₁₁H₉O₄ Coumarin, 7-ethoxy-8-hydroxy-, 2718⁷.
 C₁₁H₉O₄ Coumarin, hydroxydimethoxy-, 2719^{1,3}.
 C₁₁H₉O₄ Malonic acid, (*p*-carboxybenzyl)-, 138¹.
 Piperonylic acid, 6-hydroxy-, Me ester, acetate, 1404⁸.
 C₁₁H₉O₄ Hemimellitic acid, 4,5-dimethoxy-, 4223¹.
 C₁₁H₉AgN₂O Ketone, aminomethyl 2-methyl-3-indyl, Ag deriv., 3928⁸.
 C₁₁H₉BrN₂O₂ Asparagine, *N* α -*o*-bromobenzoyl-, 1620⁸.
 C₁₁H₉Br₂N₂O₂ *p*-Diacetaniside, 2,6-dibromo-, 3675¹.
 C₁₁H₉ClN₂O₂ Hydrazine, α -chloroacetyl-*A*-cinamyl-, 2977⁸.
 C₁₁H₉ClN₂O₂ Asparagine, *N* α -chlorobenzoyl-, 1620⁸.
 C₁₁H₉ClN₂O₂ Tyrosine, *N*-chloroacetyl-3-nitro-, 2993⁸.
 C₁₁H₉ClO₂ 1,3-Dioxolane, 2-(α -chlorostyryl), 1402⁸.
 C₁₁H₉ClO₂ Hydrocinnamic acid, 2-carboxy-5-chloro- β -methyl-, 126⁸.
 C₁₁H₉N *o*-Tolualdine, P 2185⁸.
 C₁₁H₉NO 2-Naphthamide, dihydro-, 2172².
 2 Naphthylamine, methoxy-, 833⁸, P 2188⁸.
 2(3)-Pyrrolone, 1-methyl-5-phenyl-, 1408⁸.
 8 - Pyrrolopyridine, 1 - acetyl - 2 - methyl-, 4217⁸.
- C₁₁H₉N₂O₂ Benzothiazoline, 5-methoxy-2-methyl - 1 - methylene-, CS₂ addn. compd., 390⁸.
 C₁₁H₉NO₂ Carbostyryl, 3-methoxy-1-methyl-, 2443¹.
 3-Indolepropionic acid, 834⁸.
 Isoquinoline, 3,4-dihydro-1-methyl-6,7-methylenedioxy-, 2444².
 —, 6,7-dimethoxy-, 2443⁸.
 Ketone, hydroxymethyl 2-methyl-3-indyl, 3928¹.
 2,3 - Pyrroledione, 4,5-dihydro-1-methyl-4-phenyl-, 4463⁸.
 Quinolone, 2,3-dimethoxy-, 2442².
 C₁₁H₉NO₂S Acetic acid, thiocyanato-, phenethyl ester, 4930⁸.
 Methanesulfonamide, *N*-naphthyl-, 2427⁸.
 C₁₁H₉NO₂ Pyruvic acid, cyanophenyl-, Et ester, 4463⁸.
 C₁₁H₉NO₂ Δ^2 -2-Butenol, *p*-nitrobenzoate, 2948².
 C₁₁H₉NO₂ Piperonylic acid, 6-acetamido-, Me ester, 1404⁸.
 Salicylic acid, 5-acetamido-, acetate, 3913⁸.
 C₁₁H₉NO₂S Cinnamic acid, 2,3-dimethoxy 5-nitro-, 2166⁸.
 C₁₁H₉NO₂ Pyruvic acid, (3,4-dimethoxy-2-nitrophenyl)-, 2980⁸.
 C₁₁H₉NO₂ Syringic acid, nitro-, acetate, 1405¹.
 C₁₁H₉N₂O Creatinine, 5-benzal-, 5469⁸.
 C₁₁H₉N₂O₂ Δ^2 -1-Pyrazolincarcabamamide, 5-keto-3-methylthio-, 388⁸.
 C₁₁H₉N₂O₂ Antipyrine, nitroso-, 601⁴.
 C₁₁H₉N₂O₂ 1,3,4 - Thiodiazolid - 2 - one, 4-acetyl-5-*o*-tolylimino-, 2974⁸.
 C₁₁H₉N₂O₂ 3-Hydantoinacetanilide, 2154⁸.
 C₁₁H₉N₂O₂ Asparagine, *N* α -nitrobenzoyl-, 1620⁸, 1621¹.
 C₁₁H₉N₂O₂ *o*-Acetotoluide, 4-hydroxy-3,5-di-nitro-, acetate, 1888¹.
 C₁₁H₉N₂O₂S Flavianic acid, MeNH₂ deriv., 4702¹.
 C₁₁H₉N₂O₂S Thiazole, 4-methyl-2-(β -phenylthiocarbamido)-, 2177⁸.

- $C_{11}H_{11}N_3$ Pyridine, 2-amino-6-phenylazoamino-, P 1416⁹.
Pyridine, 2,6-diaminophenylazo-, P 1416⁹.
 $C_{11}H_{11}N_3O$ Imidazole, 1,2-dimethyl-, picrate, 1638⁷.
 $C_{11}H_{15}Br_2N_2O_4$ Tyrosine, 3,5 dibromo-*N* glycy-, 2993⁹.
 $C_{11}H_{15}ClNO_2$ Butyric acid, β -benzamido- α -chloro-, 1876⁹.
 $C_{11}H_{15}ClNO_2$ *o*-Tyrosine, *N*-chloroacetyl-, 2993⁹.
 $C_{11}H_{15}ClN_2O_3$ Hydrazine, α,α -diacetyl- β 4-chloroanthranoyl-, 828².
 $C_{11}H_{15}ClN_2O_3$ Piperidine, (chlorodinitrophenyl)-, 2957⁷.
 $C_{11}H_{15}Cl_2N_2O_4$ Tyrosine, 3,5-dichloro-*N* glycy-, 2993⁹.
 $C_{11}H_{15}Cl_2O_2$ 1,3-Dioxolane, 2 (α,β -dichlorophenethyl)-, 1402⁹.
 $C_{11}H_{15}N_2O$ (See also *Antipyrine*)
Ketone, aminomethyl 2-methyl-3 indyl, and -HCl, 3928^{5,6}.
Pyrazole, 5-methoxy-3-methyl-1-phenyl-, 4701³.
Quinoline, 8-amino 6-ethoxy-, P 851⁶, P 1995⁹.
 $C_{11}H_{15}N_2OS$ Benzothiazole, 1-acetamido-3,5 dimethyl-, and hydrotribromide, 3705¹.
Benzothiazole, 3-methyl-1-methylamino-, acetyl deriv., 835⁹.
Benzothiazoline, 2 acetyl-1 imino 3,5-dimethyl-, 3705¹.
—, 1 imino-2,3-dimethyl-, acetyl deriv., 835⁹.
2(3) - Thiazolone, 4-methyl-3-*p*-toluene-, 1410⁷.
 $C_{11}H_{15}N_2O_2$ (See also *Tryptophan*)
Hydrouracil, 1-methyl-6-phenyl-, 5165⁴.
1,3,4,6 - Oxadiazin - 5(4) - one, 2,6 - dimethyl-4 phenyl-, 1904⁶.
 Δ^2 - 5 - Pyrazolinecarboxylic acid, 3-phenyl-, Me ester, 3704⁹.
 $C_{11}H_{15}N_2O_2S$ Acetic acid, (2-benzimidazolylmercapto)-, Et ester, 5164⁹.
2-Oxazolidone, 5 methyl-3-(phenylthiocarbamyl)-, 2177⁴.
Thiazole, 4-(3,4-dihydroxyphenyl)-2-(methylaminomethyl)-, and -HCl, 3470⁹.
 $C_{11}H_{15}N_2O_3$ Hydrazine, α,α -diacetyl β benzoyl-, 836².
2,5-Piperazinedione, 3-*p*-hydroxybenzyl-, 2196¹.
 $C_{11}H_{15}N_2O_4$ Barbituric acid, 5-ethyl-5-(2-furylmethyl)-, 5472⁷.
Glutaconic acid, α,γ -dicyano-, di Et ester, 375².
—, α,γ -dicyano- β -methyl-, Et Me ester, 4448¹.
Glycine, hippuryl-, 169⁹.
 $C_{11}H_{15}N_2O_4$ *o*-Acetotoluide, 4-hydroxy-6-nitro-, acetate, 1888¹.
 $C_{11}H_{15}N_2O_5$ Pyruvic acid, (3,4-dimethoxy-2-nitrophenyl)-, oxime, 2980⁹.
 $C_{11}H_{15}N_2O_5S_2$ Methionine, cyanoxylcarbonyl-, 3205⁴.
 $C_{11}H_{15}N_2S$ Pseudothiopyrine, 4701⁴.
 $C_{11}H_{15}N_3O$ Hydrazomethylene, 1-*p*-tolylazo-2-allyl-1,3-endoxy-, and -HCl, 4939⁹.
 $C_{11}H_{15}N_3OS$ Δ^2 -1-Pyrazolinecarboxylic acid, 5-keto-3-methylthiono-, β -phenylhydrazide, 140¹.
 Δ^2 - 1,2,4 - Triazoline - 3 - mercaptan, 1-acetyl-5-*p*-tolylmethyl-, 2974⁹.
 $C_{11}H_{15}N_3S$ Compd., m. 204⁹, from allyl isothiocyanate and phenylguanidine-HCl, 1640¹.
 $C_{11}H_{15}O$ Cinnamaldehyde, α -ethyl-, P 3714⁸.
1(2)-Naphthalenone, 3,4-dihydro-2-methyl-, 137⁴.
Phenol, cyclopentenyl-, 4689⁶.
 $C_{11}H_{15}O_2$ β -Butenic acid, β -methyl- γ -phenyl-, 5181².
4-Chromanone, 2,2-dimethyl-, 1901².
Cinnamic acid, Et ester, 2166⁷.
Cyclobutanecarboxylic acid, Ph ester, 4454⁸.
Ketone, cyclobutyl salicyl-, 4455⁹.
2-Naphthoic acid, tetrahydro-, 2172².
 γ -Pentenoic acid, phenyl-, 1669⁴.
1,2-Propanedione, 1-(*p*-ethylphenyl)-, 3912⁸.
—, 1-(2,5-xylyl)-, 3912⁸.
 Δ^2 Propenal, 2-methyl-, benzoate, 4928⁴.
Senecioid acid, Ph ester, 96⁹, 1901¹.
Seneciophenone, *o*-hydroxy-, 97¹, 1900⁹.
 $C_{11}H_{15}O_2$ Acetic acid, benzoyl-, Et ester, 3469¹, 3676⁸, 4941⁵.
 Δ^5 - 2,3 - Bicyclo[2.2.1]heptenedicarboxylic anhydride, 2,3-dimethyl-, 3691².
Cinnamic acid, *p*-ethoxy-, 1396¹.
Cinnamic alcohol, ester with Me acid carbonate, 124⁸.
 $C_{11}H_{15}O_2$ Benzenediacetic acid, α -methyl-, 137⁹.
Compd. from *Ginkgo biloba* leaves, 1930⁸.
5-*m*-Dioxanol, benzoate, 1875⁹.
1,3-Dioxolane-4 carbinol, benzoate, 1875⁹.
Hydrocinnamic acid, carboxy α -methyl-, 137⁶, 138².
 $C_{11}H_{15}O_2$ Isoopranic acid, Me ester, 2166⁹.
 $C_{11}H_{15}O_2S$ Benzoic acid, 2-(carboxymethylmercapto)-4-ethoxy-, P 3478¹.
 $C_{11}H_{15}O_2S_2$ Acetic acid, α,α' -(2-hydroxy-5-m-tolylenedithio)bis-, 826¹.
 $C_{11}H_{15}AsNO_6$ 1,4-Benzisoxazine-6 arsonic acid, 8-acetamido-3-hydroxy-2-methyl-, 842¹.
 $C_{11}H_{15}BO_3$ 1,2-Cyclopentenediol, 1-phenyl-, borate, 2701⁹.
 $C_{11}H_{15}BrN_2O_2$ Acetanilide, α -(α -bromopropionyl)-amino-, 1112⁹.
Hydrazine, β -acetyl- α -(α -bromopropionyl)- α -phenyl-, 1904⁹.
 $C_{11}H_{15}BrN_2S$ Benzothiazole, 5-bromo-3-methyl-1-propylamino-, and HBr, 835⁹.
 $C_{11}H_{15}BrO_2$ 2-Butanol, 3-bromo-, benzoate, 602¹.
 $C_{11}H_{15}ClN_2O_2$ Propionanilide, α -(α -chloroacetamido)-, 1112⁹.
 $C_{11}H_{15}ClO$ Hydrotubanol, chloro-, 382⁹.
 $C_{11}H_{15}Cl_2NO_2$ *p*-Acetophenetide, 3,5-dichloro-2-methyl-, 1888¹.
 $C_{11}H_{15}HgNO_3$ *p*-Acetotoluide, 2-(acetoxymercury)-, 830¹.
 $C_{11}H_{15}NO$ Acetanilide, *p*-isopropenyl-, 4688⁹.
Cinnamaldehyde, *p*-dimethylamino-, 381¹.
2-Naphthamide, tetrahydro-, 2172².
 $C_{11}H_{15}NOS$ Thymol, 6-thiocyano-, 2245¹.
 $C_{11}H_{15}NO_2$ Acetoacetotoluide, 835¹.
Cinnamamide, *p*-ethoxy-, 1396⁹.
Isocarhostyryl, 3,4-dihydro-6-methoxy-2-methyl-, 5177⁸.
Isonicotinic acid, 3-(α -ethyl- α -hydroxypropyl)-, γ -lactone, 2976⁹.
Isoquinoline, 3,4-dihydro 6,7-dimethoxy-, 2443⁹.
Levulinanilide (?), 4193³.
Nicotinic acid, 4-(α -ethyl- α -hydroxypropyl)-, γ -lactone, 2976⁹.
2-Pyrrolidone, 5-hydroxymethylphenyl-, 1408⁹.

- , 5-hydroxy-5-methyl-1-phenyl-, 4193¹.
 Quinaldic acid, 1,2,3,4-tetrahydro-, Me ester, *and* -HCl, 1411¹.
 Valeric acid, γ -anilino- γ -hydroxy-, γ -lactone (?), 4193¹.
 C₁₁H₁₃NO₂ (See also *Hydrastinin.*)
 o-Acetacetanilide, 835¹.
 o-Acetotoluide, 4-hydroxy-, acetate, 1887¹.
 1,3-Butanedione, 2-hydroxy-2-methyl-1-phenyl-, 3-oxime, 2974¹.
 Butyrophene, 4-methyl-3-nitro-, 4457¹.
 Isobutyrophene, 4-methyl-3-nitro-, 4457¹.
 Isocarbostyryl, 3,4-dihydro-5,6-dimethoxy-, 1412⁴.
 Valerophenone, *m*-nitro-, 4457¹.
 C₁₁H₁₃NO₂ Cinnamic acid, 5-amino-2,3-dimethoxy-, 2166¹.
 5-*m*-Dioxanol, carbanilate, 1875¹.
 1,3-Dioxolane-4-carbinol, carbanilate, 1876¹.
 Glutamic acid, γ -phenyl-, 2706¹.
 Hydrocinnamic acid, β -amino- α -methyl-3,4-methylenedioxy-, -HCl, 1892¹.
 —, β , β -dimethyl- γ -nitro-, 4461⁴.
 —, β -methylamino-3,4-methylenedioxy-, -HCl, P 4777¹.
 Styrene, 2-ethoxy-4-methoxy- β -nitro-, 4455¹.
 —, 4-ethoxy-3-methoxy- β -nitro-, 3230⁴.
 Veratrole, 4-allyl- γ -nitro-, 1123¹.
 C₁₁H₁₃NO₂ Acetic acid, (6-carbamyl-*m*-phenethylmercapto)-, P 3235¹, P 3478⁴.
 C₁₁H₁₃NO₂ 1,3-Dioxane, 5-methoxy-2-(*p*-nitrophenyl)-, 596¹.
m-Dioxolane, 4-(methoxymethyl)-2-(*p*-nitrophenyl)-, 596¹.
 C₁₁H₁₃N₃ 1,2,4-Triazole, 3,5-dimethyl-1-tolyl-, *and salts*, 3220⁴.
 C₁₁H₁₃N₃O Benzaldehyde, *p*-allyl-, semicarbazone, 3908¹.
 Benzaldehyde, *p*-propenyl-, semicarbazone, 3908¹.
 Cinnamaldehyde, β -methyl-, semicarbazone, 1615¹.
 C₁₁H₁₃N₃O₂ Oxazolidine, 2-imino-5-methyl-3-(phenylthiocarbamyl)-, 2177¹.
 Δ^2 -Oxazoline, 5-methyl-2-(phenylthiocarbamido)-, 2177⁴.
 C₁₁H₁₃N₃O₂ *p*-Acetophenetide, methylidinitro-, 1888¹.
 Tyrosine, *N*-glycyl-3-nitro-, 2993¹.
 C₁₁H₁₃N₃O₂ Asparagine, *N*¹-(4-nitro-*m*-tolylsulfonyl)-, 1620¹, 1621¹.
 C₁₁H₁₃N₃S Thiazole, 2-amino-5-(aminotolyl)-4-methyl-, *and salts*, 1410⁴.
 Thiazole, 4-methyl-2-(β -tolylhydrazino)-, 1410⁴.
 Δ^2 -Thiazoline, 2-imino-4-methyl-3-*p*-toluino-, 1410¹.
 C₁₁H₁₃N₃ Guanazole, *N*¹-allyl-2-phenyl-, 1640¹.
 C₁₁H₁₃AsClN₃O₂ Carbanilic acid, 3-acetamido-5-amino-2-hydroxy-, β -chloroethyl ester, 843¹.
 C₁₁H₁₃BrNO₂ Compd., *m*. 63°, from butein & Br, 1892¹.
 C₁₁H₁₃Br₂O₂ Arabinose, (2,5-dibromophenyl)hydrazone, 1400¹.
 C₁₁H₁₃Br₂O₂ Phenol, 5-(dibromopropyl)-2-ethoxy-, 1890¹.
 C₁₁H₁₃Br₂N₃S Benzothiazole, 3-methyl-1-propyl-amino-, tetrabromide, 835¹.
 C₁₁H₁₃ClNO Benzamide, *N*- β -chlorobutyl-, 4694¹.
 C₁₁H₁₃ClNO₂ *p*-Acetophenetide, α -chloro-2-methyl-, 1888¹.
 1-Butanol, 4-chloro-, carbanilate, 4444¹.
 C₁₁H₁₃ClN₃O Butyrophene, γ -chloro-, semicarbazone, 2438¹.
 C₁₁H₁₃I₂NO 3,4-Dihydro-6-methoxy-2-methylisoquinolinium iodide, 5177¹.
 C₁₁H₁₃I₂NO 3,4-Dihydro-6-methoxy-2-methylisoquinolinium iodide, diiodide, 5177¹.
 C₁₁H₁₃I₂NO 3,4-Dihydro-6-methoxy-2-methylisoquinolinium iodide, tetraiodide, 5177¹.
 C₁₁H₁₃N₃ Hydrocinnamonitrile, α -dimethyl-amino-, *and* -HCl, 4269⁴.
 C₁₁H₁₃N₃O (See also *Cytisin.*)
^c Cinnamaldehyde, *p*-dimethylamino-, oxime, 381¹.
 Piperazine, 1-benzoyl-, 2183¹.
 C₁₁H₁₃N₃O₂ Oxazolidine, 5-(benzylmercapto-methyl)-2-imino(?), 2177¹.
 Δ^2 -Oxazoline, 2-amino-5-(benzylmercapto-methyl)-(?), 2177¹.
 Urea, acetylthio-2,4-xylyl-, 3705¹.
 C₁₁H₁₃N₃O₂ 2-Benzimidazolecarbinol, 5-ethoxy- α -methyl-, 1417¹.
 Pyruvic acid, 2,5-xylylhydrazone, 4699¹.
 C₁₁H₁₃N₃O₂ Alanine, *N*-glycyl- β -phenyl-, 1112¹, 2196¹, 2697¹, 2698¹, 2992¹.
 Asparagine, *N*¹-tolyl-, 4674¹.
 Barbituric acid, α -methylbutenyl-, P 2534¹.
 —, 5- Δ^1 -cyclopentenyl-5-ethyl-, P 483¹.
 Glycine, *N*- β -phenylalanyl-, 2992¹.
 Hydratropic acid, α - (aminooacetamido)-, 2697¹, 2698¹.
 C₁₁H₁₃N₃O₂ *p*-Acetophenetide, methylnitro-, 1888¹.
 Aniline, *N*-butyl-4,5-methylenedioxy-2-nitro-, 4204¹.
 Asparagine, *N*¹-*o*-anisyl-, 4674¹.
 Tyrosine, *N*-glycyl-, 2196¹, 2993¹, 5476¹.
 C₁₁H₁₃N₃O₂ Asparagine, *N*¹-*p*-tolylsulfonyl-, 1620¹.
 C₁₁H₁₃N₃O₂ Dialuric acid, 5-(hydroxymethyl)-1,3-dimethyl-, diacetate, 2442¹.
 C₁₁H₁₃N₃S Benzothiazole, 3-methyl-1-propyl-amino-, *and* -HBr, 835¹.
 C₁₁H₁₃N₃O₂ Caffeine, α -allyloxy-, P 612¹.
 C₁₁H₁₃N₃O₂ (Formylhydroxymethyl)trimethyl ammonium picrate, 2150¹.
 C₁₁H₁₃O₂ *m*-Cresol, butenyl-, 4690¹.
 Ether, α -methylenebenzyl propyl-, 2417¹.
 Ether, propyl styryl-, 2417¹.
 Ethylene oxide, α -ethyl- α -methyl- β -phenyl-, 2958¹.
 Δ^2 -2-Pentenol, 2-phenyl-, 1870¹.
 Phenol, *p*-cyclopentyl-, 4689¹.
 C₁₁H₁₃O₂ Benzaldehyde, *p*-butoxy-, 1396¹.
 Benzaldehyde, *p*-isobutoxy-, 1397¹.
 Benzoic acid, Bu ester, 1348¹; isobutyl ester, 3938¹.
 —, *o*-*tert*-butyl-, 115¹.
 Cyclopentadienebenzoquinone, tetrahydro-, 1623¹.
 1,2-Cyclopentanediol, 1-phenyl-, 2095¹, 2701¹.
m-Dioxane, 2-*m*-tolyl-, 4671¹.
 Hydrocinnamic acid, β , β -dimethyl-, 4461⁴.
 Hydrotubanol, 382¹.
 Phenol, 5-allyl-2-ethoxy-, 1124¹, 1889¹.
 —, 2-ethoxy-4-propenyl-, P 1910¹.
 α -Toluic acid, α -isopropyl-, *and* As salt, 4461¹.
 Valeric acid, phenyl-, 1669¹.
 C₁₁H₁₃O₂ Acetophenone, 4-ethoxy-3-methoxy-, 3979¹.
 Benzoic acid, *p*-isobutoxy-, 823¹.
 2-Butanone, 4-*p*-anisyl-4-hydroxy-, 4687¹.

- Carbinol, phenethyloxy-, acetate, 1871⁸.
 Carbonic acid, Et phenethyl ester, 124⁸.
 Δ^1 -Cyclopentaneacetic acid, 2-hydroxy-5-ketotetramethyl-, 1623⁹.
m-Dioxane, 2-*p*-anisyl-, 4671¹².
 5-*m*-Dioxanol, 2-*m*-tolyl-(?), 4671¹².
 1,3-Dioxolane-4-carbinol, 3-*m*-tolyl-(?), 4671¹².
 Furanacrylic acid, Bu ester, 3993⁷.
 Isovalerophenone, 3,4-dihydroxy-, 2161⁶.
 Salicylic acid, Bu ester, 1348⁸; isobutyl ester, 3938⁹.
 Veratraldehyde, 6-ethyl-, 843³.
 $C_{11}H_{11}O_4$ Acetophenone, ethoxyhydroxy-methoxy-, 1403⁹.
 Anisyl alcohol, ester with Et acid carbonate, 124⁷.
 Cyclopentaneacetic acid, 1-hydroxy-2,5-diketone- α , α , 3,3-tetramethyl-, β -lactone, 1624¹⁴.
 Cyclopentanemalonic acid, 1-(β , β -dihydroxypropyl)-, dilactone, 3673¹.
 5-*m*-Dioxanol, 2-*p*-anisyl-(?), 4671¹².
 1,3-Dioxolane-4-carbinol, 2-*p*-anisyl-(?), 4671¹².
 2-Furanpropionic acid, α -acetyl-, Et ester, 5472⁷.
 Isoxylic acid, 4,6-dimethoxy-, 1894⁸.
 Rhizonic acid, Me ester, 1894⁸.
 Veratric acid, 6-ethyl-, 843³.
 $C_{11}H_{11}O_4$ Anisic acid, 2-ethoxy-6-hydroxy-, Me ester, 1403⁹.
 $C_{11}H_{11}O_4$ Acetophenone, 2,4-dihydroxy- α , 3,6-trimethoxy-, 2181⁶.
 Δ^1 -Cyclohexenepropionic acid, 4,5-dicarboxy-, and *Pb* salt, 3692⁴.
 $C_{11}H_{11}S_2$ 2-*p*-Cymenecarboxylic acid, dithio-, and *Zn* salt, 115⁴.
 $C_{11}H_{11}BrN_2O_2$ See *Pernocton*.
 $C_{11}H_{11}BrN_2S$ Urea, α -(5-bromo-*o*-tolyl)- β -propylthio-, 835⁸.
 $C_{11}H_{11}ClHgO_2$ 1-Propanol, 3-(chloromercuri)-2-ethoxy-3-phenyl-, P 3234⁷.
 $C_{11}H_{11}ClN_4O_2$ Xanthine, 8-chloro-1,3,7-triethyl-, 3903⁹.
 $C_{11}H_{11}HgNO_2$ Aniline, *p*-(acetoxymethyl)-*N*-ethyl-*N*-methyl-, 1888⁸.
 $C_{11}H_{11}HgNO_2$ Toluidine, *N*-(acetoxymethyl)-acetate, 1121⁷.
 $C_{11}H_{11}HgNO_2$ *p*-Anisidine, *N*-(acetoxymethyl)-acetate, 1121⁷.
 $C_{11}H_{11}IN$ Diethylbenzimidazolium iodide, 1638⁵.
 $C_{11}H_{11}N$ Aniline, *p*-isobutyl-*N*-methyl-, 4689¹.
 Aniline, *p*-isopropenyl-*N*, *N*-dimethyl-, and -*HCl*, 4688⁸.
 —, *N*- α -methyl- Δ^1 -butenyl-, P 3052⁷.
 γ -Pentenitrile, α , α -diallyl-, P 2987⁸.
 $C_{11}H_{11}NO$ Butyrophenone, 3-amino-4-methyl-, and -*HCl*, 4457⁷.
 4(5)-Indolone, 6,7-dihydro-3,6,6-trimethyl-, 2716¹.
 Isobutyrophenone, 3-amino-4-methyl-, and -*HCl*, 4457⁷.
 Isoquinoline, 1,2,3,4-tetrahydro-6-methoxy-2-methyl-, and -*HI*, 5177⁷.
 Valerophenone, *m*-amino-, and -*HCl*, 4457⁷.
 $C_{11}H_{11}NO_2$ (See also *Butesin*.)
 Acetamide, *N*-(β -hydroxy- α -methylphenethyl)-, 3689⁹.
p-Acetophenetide, 2-methyl-, 1888⁸.
 Alanine, *N*, *N*-dimethyl- β -phenyl-, 4269¹.
 Aniline, allyldimethoxy-, 1124¹.
 2-Butanol, 4-phenyl-, carbamate, P 3476⁹.
 Hydrocinnamic acid, β -amino- α -ethyl-, -*HCl*, 1892⁸.
 —, *o*, *o*-dimethylamino-, and -*HCl*, 126³.
 —, β -dimethylamino-, -*HCl*, P 4777⁷.
 Isocarbostryl, 1,2,3,4-tetrahydro-6-methoxy-2-methyl-, 5177⁷.
 Isovaleranihde, *o*-hydroxy-, 4940¹.
 Norephedrine, *N*-acetyl-, 2705⁷.
 Valeranihde, *o*-hydroxy-, 4940¹.
 $C_{11}H_{11}NO_2$ *o*-Acetotoluide, 4-(β -hydroxyethoxy)-, 1888⁸.
 Anhalamine, 1888⁸.
 2-Butanone, 4-*p*-anisyl-1-hydroxy-, oxime, 4687⁷.
 Ascorbic acid, *N*, *N*-dimethyl- β -phenyl-, 4684⁷.
 Phenethylamine, *N*-formyl-3,4-dimethoxy-, 2443⁹.
 3-Pyrrolopropionic acid, 2-formyl-4-, dimethyl-, Me ester, 4226⁴.
 $C_{11}H_{11}NO_3$ Morpholine, 4-*p*-tolylsulfonyl-, P 2723⁷.
 $C_{11}H_{11}NO_4$ 1,2-Cyclobutanedicarboxylic acid, 1-cyano-, di-Et ester, 2424⁸.
 3-Pyrrolopropionic acid, 5-carboxy-1-methyl-, Et ester, 1134⁸.
 $C_{11}H_{11}NO_5$ *p*-Acetophenetide, *N*-(methylsulfonyl)-, 2704⁷.
 $C_{11}H_{11}NO_5$ Norephedrine, oxalate, 3689⁷.
 Norepseudophedrine, oxalate, 3689⁹, 3690¹.
 $C_{11}H_{11}NO_5$ Acetamidide, α -(alanylamino)-, 1113¹.
 Acetophenone, 4-methoxy-3-methyl-, semicarbazone, 1309⁸.
 Benzaldehyde, *p*-propoxy-, semicarbazone, 1396⁸.
 Biuret, 1-phenyl-1-propyl-, 3442⁶.
 Propionanilide, α -glycylamino-, 1112⁹.
 $C_{11}H_{11}NO_5S$ Carbazic acid, β -(thio-*p*-tolylcarbonyl)-, Et ester, 2963⁷.
 $C_{11}H_{11}NO_5$ 2(1)-*s*-Triazone, 4-(*p*-dimethylphenyl)tetrahydro-6-imino-, and salts, 4220⁷, 4221¹, 4221¹.
 $C_{11}H_{11}NO_5$ Propionamide, α -amino-*N*- β -hydroxyethyl-, picrate, 1112⁷.
 $C_{11}H_{11}NO_5S$ Urea, α -allyl- β -(imino- β -phenylhydrazinomethyl)thio-, 1640¹.
 $C_{11}H_{11}$ Benzene, amyl-, 4440⁸.
 Benzene, pentamethyl-, 5469⁸.
 Toluene, *p*-*tert*-butyl-, 2431¹.
 $C_{11}H_{11}AsCl_2N$ Arsine, dichloro[γ -(α -methylbenzylamino)propyl]-, -*HCl*, 92⁸.
 $C_{11}H_{11}AsNO_2$ Alapine, *N*-(*p*-arsenophenyl)-, Et ester, 2954⁹.
 $C_{11}H_{11}IN$ 1,2,3,4-Tetrahydro-2,2-dimethylisoquinolinium iodide, 5178¹.
 $C_{11}H_{11}NO_5S$ Carbamic acid, β -*p*-thiono-, Bu and isobutyl esters, 598⁹.
 $C_{11}H_{11}NO_5$ Formic acid, α , β -dimethyl- β -(2,5-xyllyl)hydrazide, 4699⁷.
 Urea, α -butyl- α -phenyl-, 3442⁶.
 —, carvacryl-, 5470³.
 $C_{11}H_{11}NO_5S$ Carbazic acid, β -ethyl- β -phenylthiono-, Et ester, 2953⁷.
 $C_{11}H_{11}NO_2$ (See also *Pilocarpine*.)
 Benzylamine, *N*, *N*-diethylnitro-, 2428¹.
 Carbamic acid, methyl-, α -dimethylamino tolyl ester, 2760³.
 3-Indazolecarboxylic acid, 2-ethyl-4,5,6,7-tetrahydromethyl-, 2972¹⁴.
 —, 4,5,6,7-tetrahydro-4,6-dimethyl-, Me ester, 2972⁹.
 —, 4,5,6,7-tetrahydromethyl-, Et ester, 2971⁹, 2972⁹.
 —, 4,5,6,7-tetrahydro-2,4,6-trimethyl-, 2972⁹.

- 3-Isindazolecarboxylic acid, 1-ethyl-4, 5, 6, 7-tetrahydro-, Me ester, 2971¹.
- , 1-ethyl-4, 5, 6, 7-tetrahydromethyl-, 2972^{1,4}.
- , 4, 5, 6, 7-tetrahydromethyl-, Me ester, 2972^{1,3}.
- , 4, 5, 6, 7-tetrahydro-1, 4, 6-trimethyl-, 2972³.
- Lactamide, *N*-methyl- β -methylamino- β -phenyl-, 4684³.
- C₁₁H₁₄N₂O₂S Piperazine, 1-*p*-tolylsulfonyl-, 2183².
- C₁₁H₁₄N₂O₂ Barbituric acid, 1-allyl-5, 5-diethyl-, 821⁴. Barbituric acid, 5-allyl-5-isobutyl-, P 4950².
- C₁₁H₁₄N₂O₄ Aniline, 4, 5-dimethoxy-2-nitro-*N*-propyl-, 4204³.
- Barbituric acid, 5-ethyl-5-(tetrahydro-2-furylmethyl)-, 3024¹.
- C₁₁H₁₄N₂O₄S 4-Pyrimidinecarboxylic acid, 5-ethoxy-2-(ethylmercapto)-1, 6-dihydro-6-keto-, Et ester, 1905³.
- C₁₁H₁₄N₂O₄S Benzothiazole, 1-amino-3, 5-dimethyl-, methosulfate, 3705³.
- C₁₁H₁₄N₂S Urea, α -propylthio- β -*o*-tolyl-, 835².
- C₁₁H₁₄N₂O₂ Xanthine, 1, 3, 7-triethyl-, 3903³.
- C₁₁H₁₄N₂O₂ Caffeine, α -isopropoxy-, P 612².
- Caffeine, α -propoxy-, P 612².
- 3-Pyrrolepropionic acid, 2-formyl-4, 5-dimethyl-, semicarbazone, 4226³.
- Xanthine, 8-ethoxy-3, 7-diethyl-, 3903³.
- C₁₁H₁₄N₂O₄ Acetoacetic acid, Et ester, (4, 5-dihydro-5-keto-3-methyl-1-pyrazolyl-carbonyl)hydrazone, 5164³.
- C₁₁H₁₄N₂O₄ Butylamine, γ -methoxy-, picrate, 4669³.
- C₁₁H₁₆O Benzyl alcohol, α , α -ethyl-, 4465¹.
- Compd., b₁ f21-2°, from acetone and methylcyclohexenealdehyde, 3692³.
- m*-Cresol, 4-butyl-, 4690¹.
- Jasmone, 1468³.
- Nopinol, ethyl-, 5466¹.
- C₁₁H₁₆OS 1-Pentanol, 5-phenylmercapto-, 2423¹.
- C₁₁H₁₆O₂ Benzene, 1-ethoxy-4-ethyl-2-methoxy-, 2979³.
- Methane, ethoxyphenethyloxy-, 1871³.
- Phtnol, 2-ethoxy-5-propyl-, 1890².
- , *m*-isoamoxy-, 1131¹.
- Spiro[cyclohexane-1, 4'-1, 4-*p*-pyran] 2'(3')-one, 6'-diethyl-, 3672³.
- 5, 6-Spirodecane-6, 8^a diene, 7-methyl-, 2946².
- C₁₁H₁₆O₂ Camphocarboxylic acid, *Bi* salt, 2534³, 4536².
- Δ^2 -Cyclopentene-carboxylic acid, 4-isopropyl-2-keto-1-methyl-, Me ester, 1625¹.
- Ethanol, benzyloxyethoxy-, P 3931⁴.
- C₁₁H₁₆O₂S *p*-Toluenesulfonic acid, *Bu* ester, 2150².
- C₁₁H₁₆O₄ Cyclopentaneacetic acid, 2, 5-diketo- α , α , 3, 3-tetramethyl-, 1623³, 1624⁴.
- Pimelic acid, γ , γ -dihydroxy- α , α , ϵ -tetramethyl-, dilactone, 1623².
- C₁₁H₁₆O₄ Cyclopentanemalononic acid, 1-acetonil-, 3672³, 3673¹.
- Pimelic acid, β , γ , γ -trihydroxytetramethyl-, dilactone, 1624³.
- C₁₁H₁₆O₄ 5, 8'-Spirobi[*m*-dioxane]-2, 2'-dicarboxylic acid, 2, 2'-dimethyl-, 99², 1616¹.
- C₁₁H₁₇AsN₂O₂S Phenylthioarsinous acid, 3-amino-4-methylamino-, dicarbamylmethyl ester, 3678¹.
- C₁₁H₁₇BrO₂ Glutaric acid, α -acetyl- α -bromo-, di-Et ester, 1011¹.
- C₁₁H₁₇ClN₂O Trimethyl(phenylcarbonylmethyl)-ammonium chloride, 3023¹.
- C₁₁H₁₇ClN₂O₂ [(*p*-Hydroxyphenyl)carbonylmethyl]trimethylammonium chloride, 3023¹.
- C₁₁H₁₇ClN₂O₂S Pyrimidine, 4-chloro-5-ethoxy-6-(ethoxymethyl)-2-(ethylmercapto)-, 1905⁴.
- C₁₁H₁₇Cl₂O₂ β -Glucochloralose, trimethyl-, 1391².
- Glucose, 3, 5, 6-trimethylmonochloral-, 1391².
- C₁₁H₁₇N Indole, 4, 5, 6, 7-tetrahydro-3, 6, 6-trimethyl-, 2716⁴.
- C₁₁H₁₇NO Benzyl alcohol, α -(α -ethylaminoethyl)-, 4205³; and -HCl, 3454¹.
- Benzyl alcohol, α -(ethylaminomethyl)-*p*-methyl-, and -HCl, 3454².
- Benzylamine, α -methoxy-*N*, *N*, α -trimethyl-, and -HCl, 3451^{1,3}.
- 1-Butanol, 3-methylamino-3-phenyl-, 4462¹.
- Ephedrine, methyl-, 3982³, 4205², and -HCl, 4462^{3,4}, and salts, 1472^{3,3}, 3690^{2,3}.
- 2-*p*-Menthanenitrile, 3-keto-, P 3931⁴.
- Phenethyl alcohol, α -(dimethylaminoethyl)-, 4269².
- 1-Propanol, 2-dimethylamino-3-phenyl-, 4269⁴.
- Pseudoephedrine, methyl-, 3690², and salts, 1472².
- C₁₁H₁₇NO₂ Anisyl alcohol, α -(dimethylaminoethyl)-, 4269⁴.
- Benzyl alcohol, α [(β -hydroxyethylamino)ethyl]-, and -HCl, 3454¹.
- Phenethylamine, 4-ethoxy-3-methoxy-, 4227¹, and -HCl, 3230⁴, and salts, 2951².
- C₁₁H₁₇NO₂S Methanesulfonanilide, *N*-butyl-, 2427¹.
- Methanesulfonanilide, *N*-sec-butyl-, 2427³.
- C₁₁H₁₇NO₂ Caproic acid, α -cyano- δ -keto- β , β -dimethyl-, Et ester, 2152².
- C₁₁H₁₇NO₂S Methanesulfonamide, *N*, δ -phenoxybutyl-, 2427¹.
- 2-Propanesulfonanilide, *N*-ethyl-2-hydroxy-, 95⁴.
- C₁₁H₁₇NO₂ Proline, 1-acetylhydroxy-, Et ester, acetate, 5161².
- C₁₁H₁₇N₃ Guanidine, α , α -diethylphenyl-, P 5194².
- C₁₁H₁₇N₂O Semicarbazide, carvacryl-, and -HCl, 5470^{2,4}.
- C₁₁H₁₇N₂O₂ Semicarbazone, *m*. 133°, of aldehyde b₁ 116-20°, 2984¹.
- C₁₁H₁₇N₂S Semicarbazide, 1-carvacrylthio-, 5470⁴.
- C₁₁H₁₈ Fenchene, methyl-, 4666³.
- C₁₁H₁₈AsN₂O₂ Triglycolarsenic acid, pyridine salt, 595².
- C₁₁H₁₈BrNO Trimethyl(β -phenoxyethyl)ammonium bromide, 3023¹.
- C₁₁H₁₈BrN₂O₂ Glycine, *N*-[*N*-(α -bromosulvaleryl)glycyl]glycyl-, 4232².
- C₁₁H₁₈ClNO [α -(1-hydroxymethyl)benzyl]trimethylammonium chloride, 4269².
- (β -Hydroxyphenethyl)trimethylammonium chloride, 4269².
- C₁₁H₁₈ClN₂O₂ Valine, *N*-[*N*-(*N*-chloroacetyl)glycyl]glycyl-, 4232².
- C₁₁H₁₈Cl₂O₂ Glucose dichloroacetaldehyde, (11-methyl-, 1391².
- C₁₁H₁₈INO (*m*-Hydroxy- α -methylbenzyl)trimethylammonium iodide, 3451².
- [α -(Hydroxymethyl)benzyl]trimethylammonium iodide, 4269².

- (β - Hydroxyphenethyl)trimethylammonium iodide, 4269⁵.
- $C_{11}H_{11}N_3$ Indazole, 2-ethyl-4,5,6,7-tetrahydro-4,6-dimethyl-, 2972².
- Isoindazole, 1-ethyl-4,5,6,7-tetrahydro-4,6-dimethyl-, 2972².
- $C_{11}H_{11}N_2O_3S$ Pyrimidine, 5-ethoxy-4-(ethoxymethyl)-2-(ethylmercapto)-, 1905⁴.
- $C_{11}H_{11}N_2O_2$ (See also *Amytal*.)
- Barbituric acid, 5-amyl-5-ethyl-, 3024¹.
- , isobutylpropyl-, P 5012².
- $C_{11}H_{11}N_2O_2S$ 4(3) - Pyrimidone, 5-ethoxy-6-(ethoxymethyl)-2-(ethylmercapto)-, 1905⁴.
- $C_{11}H_{11}N_2O_4$ Barbituric acid, 5-(butoxymethyl)-5-ethyl-, 4744⁸.
- Barbituric acid, 5-ethyl-5-(isobutoxymethyl)-, 4744⁸.
- $C_{11}H_{11}O$ Compd., b_p 93-5°, from crotonaldehyde and dimethylpentadiene, 3692⁸.
- Cyclohexanone, 4-cyclopentyl-, 4689⁷.
- $C_{11}H_{11}O_2$ Acid, m. 88.5-9°, from crotonic acid and dimethylpentadiene, 3692⁷.
- Camphanecarboxylic acid, 2433².
- Camphor, 3-methoxy-, 3693⁴.
- Δ^1 -Cyclohepteneacetic acid, Et ester, 4675⁸.
- $C_{11}H_{11}O_2$ Cyclohexaneacetic acid, 1-acetyl-, 3672².
- Cyclopentaneacetic acid, 1-acetyl-, Me ester, 3673².
- Cyclopentanecarboxylic acid, 4-isopropyl-2-keto-1-methyl-, Me ester, 1625².
- $C_{11}H_{11}O_4$ 1,1-Cyclohexanediacetic acid, mono-Me ester, *Ag salt*, 3672².
- Cyclopropaneacetic acid, 2-carboxy-1-isopropyl-, di-Me ester, 1624².
- $C_{11}H_{11}O_4$ 1,1-Cyclobutanedicarboxylic acid, 3-amoxy-, and *Cu salt*, 2700².
- Malonic acid, (γ -keto- α , α -dimethylbutyl)-, 2162².
- Phoronic acid, 1623¹.
- Xylose, diacetone-, 2622¹.
- $C_{11}H_{11}O_7$ *d*-Glucose, 3-acetyl-1,2-isopropylidene-, 4674².
- d*-Glucose, acetylmonoacetone-, 4195⁴.
- $C_{11}H_{11}O_8$ + 8H₂O, 930⁴.
- $C_{11}H_{11}O_2N$ β -Alanine, *N*-(*N*-chloroacetyl-leucyl)-, 2991¹.
- $C_{11}H_{11}ClO$ Undecanaphthenoyl chloride, 4935⁹.
- $C_{11}H_{11}ClO_2$ Glucose monochloroacetaldehyde, trimethyl-, 1391¹.
- $C_{11}H_{11}IN$ Ethyl-4,5,6,7-tetrahydrodimethylindazolium iodide, 2972².
- 4,5,6,7-Tetrahydro-1,2,4,6-tetramethylindazolium iodide, 2972².
- $C_{11}H_{11}N$ Compd. from sparteine, *salts*, 5188¹.
- $C_{11}H_{11}NO$ 2(3)-Pyrrolone, 5-hexyl-1-methyl-, 4469⁴.
- $C_{11}H_{11}NO_3S$ Acetic acid, thiocyan-, octyl ester, 4930⁴.
- $C_{11}H_{11}NO_2$ Glutaric acid, α -(α -aminoethylidene)-, di-Et ester, 101¹.
- $C_{11}H_{11}NO_3$ Glutamic acid, *N*-acetyl-, di-Et ester, 5161¹.
- $C_{11}H_{11}N_2O$ Cyclohexenealdehyde, trimethyl-, semicarbazone, 3692².
- 2-Propanone, 1- Δ^1 -cycloheptenyl-, semicarbazone, 4678².
- , 1-cycloheptylidene-, semicarbazone, 4678².
- $C_{11}H_{11}N_2O_2$ Cyclopentaneacetic acid, 1-acetyl-, semicarbazone, 3673².
- Cyclopentaneacetic acid, 1-acetyl-, Me ester, semicarbazone, 110⁴.
- Cyclopentanecarboxylic acid, 4-acetyl-2,2-dimethyl-, semicarbazone, 3694¹.
- Pinonic acid, semicarbazone, 2167¹.
- $C_{11}H_{11}BrN_2O_2$ Glycine, *N*-(*N*-valylglycyl)-glycyl-, 4232².
- $C_{11}H_{11}ClN_2O_2$ Ethanol, 2-trichloro-1-[α -dimethylammonomethyl]- α -methylpropoxy-, acetate, and *its* -HCl, 374².
- $C_{11}H_{11}MoN_2OS_2$, 2899⁶.
- $C_{11}H_{11}N_2O_2$ Piperazineone, isobutylisopropyl-, 1147².
- $C_{11}H_{11}N_2O_4$ 1-Piperazineacetic acid, 4-carboxy-, di-Et ester, 2183⁴.
- $C_{11}H_{11}N_2O_3$ Hydantoic acid, δ -(β -carboxyisopropyl)-, di-Et ester, 1618⁷.
- $C_{11}H_{11}N_2O_4$ Valine, *N*-(*N*-(*N*-glycylglycyl)-glycyl)-, 4232².
- $C_{11}H_{11}O$ 2-Camphanecarbinol, 2433².
- Cyclohexanol, 4-cyclopentyl-, 4689⁶.
- Δ^1 -Cyclohexanol, 2-ethyl-5-isopropyl-, 4464².
- Isofenchol, methyl-, 4686².
- $C_{11}H_{11}O_2$ Bornylenglycol, allomethyl-, 3693⁴.
- Cyclohexanevaleric acid, P 848².
- Cyclohexanone, isomox-, 1131^{2,8}.
- Undecanaphthenic acid, 4935⁷.
- Undecylenic acid, 1745⁹.
- $C_{11}H_{11}O_4$ Pelargonic acid, θ hydroxy-, acetate, 3663¹.
- $C_{11}H_{11}O_5$ Mannonic acid, 2-carbomethoxy-3,4,6-trimethyl-, 2423⁸.
- $C_{11}H_{11}BrO_2$ Undecylic acid, κ -bromo-, 3663⁹.
- $C_{11}H_{11}Cl$ Undecanaphthenyl chloride, 4935⁹.
- $C_{11}H_{11}NO$ Menthone, 2-(aminomethyl)-, P 3931⁴.
- Norisocampholamide, *N*-ethyl-, 1405⁸.
- Undecylonitrile, κ -hydroxy-, 3663⁹.
- $C_{11}H_{11}NO_2$ Butyric acid, β -(1-piperidyl)-, Et ester, 3207⁴.
- Cyclohexanone, isomox-, oxime, 1131^{2,8}.
- $C_{11}H_{11}N_2O$ Cyclohexanone, 4-butyl-, semicarbazone, 4690¹.
- Menthone, semicarbazone, 2155⁴.
- β -Octenaldehyde, β , γ -dimethyl-, semicarbazone, 1614⁸.
- Semicarbazone, m. 190⁹, of ketone b_p 104-5°, 4689⁹.
- $C_{11}H_{11}N_2O_2$ 2-Propanone, 1-(1-methoxycyclohexyl)-, semicarbazone, 4454².
- $C_{11}H_{11}N_2O_4$ Caproic acid, δ -keto- β , γ -dimethyl-, Et ester, semicarbazone, 2153².
- Caprylic acid, δ -keto- β , γ -dimethyl-, semicarbazone, 2156².
- $C_{11}H_{11}N_2O_3$ Alanine, *N*-(*N*-leucylglycyl)-, 4233².
- β -Alanine, *N*-(*N*-glycylleucyl)-, 2991¹.
- Leucine, *N*-(*N*-(β -aminopropionyl)glycyl)-, 2991¹.
- $C_{11}H_{11}$ Hendecene, 5014¹.
- Undecanaphthene, 4935⁹.
- $C_{11}H_{11}AsNO_3$ Nipecotic acid, 1-(γ -arsonopropyl)-, Et ester, 93¹.
- $C_{11}H_{11}BrNO_2$ 1-(Carboxymethyl)-1-ethylpiperidinium bromide, Et ester, 3022⁷.
- $C_{11}H_{11}IN$ Trimethyl-2-norcamphanylmethylammonium iodide, 3692².
- $C_{11}H_{11}INO_2$ 1-(β -Carboxyethyl)-1-methylpiperidinium iodide, Et ester, 1390².
- $C_{11}H_{11}N_2O_3$ Glycine, *N*-leucyl-, isopropyl ester, -HCl, 603⁷.
- $C_{11}H_{11}N_2O_2S_2$ Methionic acid, dipiperidide, 98⁷.
- $C_{11}H_{11}N_2S_2$ Piperidinecarboxylic acid, thio-, piperidine salt, 4374².
- $C_{11}H_{11}N_2O_2$ Homolevulinamide, *N*, *N*-diethyl-, semicarbazone, 4190².
- $C_{11}H_{11}N_2O_2$ 2-Butanone, 1-cyclopentylidene-, semicarbazidosemicarbazone, 2946¹.

- C₁₁H₂₀O Ether, cyclohexyl isoamyl, 3674¹.
 Hendecanone, 1872², 2934⁷, 4440⁸.
 Pelargonaldehyde, γ , η -dimethyl-(?), 3702⁹.
 Undecanaphthenol, 4935⁸.
- C₁₁H₂₀O₂ Butyric acid, α , α -dimethyl-, Am ester, 3438⁹; iso-Am ester, 3438⁹.
 Cyclohexanol, isoamoxy-, 1131^{1,7}.
m - Dioxane, 2 - isopropyl - 4, 4, 6, 6 - tetramethyl-, 1615⁹.
 Pelargonic acid, γ , η -dimethyl-, 3702⁹.
 C₁₁H₂₀O₃ Capric acid, ω -hydroxy-, Me ester, 1388⁹, 3663⁷.
 Carbonic acid, diiso-Am ester, 1058¹.
 Undecylic acid, α -hydroxy-, 1388⁹, 3663⁷.
 C₁₁H₂₀O₄ Glucose, pentamethyl-, 821⁷.
 Glucoside, tetramethyl- α -methyl-, 5089⁸.
- C₁₁H₂₁N Cyclohexylamine, *N*, *N*-dimethyl-2-propyl-, 1886⁴; and chloroaurate, 1443⁴.
 Cyclohexylamine, *N*-(α -ethylpropyl)-, and -HCl, 111⁹.
 Dipropylamine, *N*- α -methyl- Δ^1 -butenyl-, P 3052⁷.
- C₁₁H₂₁NO Cyclohexylamine, 3-isoamoxy-, and salts, 1131⁴.
 6-Hendecanone, oxime, 4440⁸.
 Pelargonamide, γ , η -dimethyl-, 3702⁹.
 2-Pentanol, 4-cyclohexylamino-, and -HCl, 111⁹, 112³.
- C₁₁H₂₁NO₂ β -Alanine, *N*, *N*-dipropyl-, Et ester, 1390⁹.
 C₁₁H₂₁NO₂S Methanesulfonamide, *N*-menthyl-, 2427⁸.
- C₁₁H₂₁NO₃ Arabinamine, *N*-cyclohexyl-, and -HCl, 111⁹, 112³.
- C₁₁H₂₁NS₂ Decyl alcohol, dithiocarbamate, 4669⁹.
- C₁₁H₂₁N₂O Caprylaldehyde, β , δ -dimethyl-, semicarbazone, 1614⁹, 5467⁸.
- C₁₁H₂₄ Nonane, 2, 6-dimethyl-, 2421¹.
 Octane, 2, 3, 7-trimethyl-, 2421¹.
- C₁₁H₂₄AsNO₃ 1-Propylarsonic acid, 3-(2, 2, 6-trimethyl-1-piperidyl)-, 92⁹.
- C₁₁H₂₄AsNO₄ 1-Propanearsonic acid, 3-(4-hydroxy - 2, 2, 6 - trimethyl - 1 - piperidyl) -, 92⁹.
- C₁₁H₂₄N₂O Urea, α , α -diisoamyl-, 3442⁹.
- C₁₁H₂₄N₂O₂ Carbamic acid, (β -aminoethyl)-, Et ester, CO₂ addn. compd., 2133⁴.
- C₁₁H₂₄N₂O₂S₂ Methionamide, *N*, *N'*-diamyl *N*, *N'*-dinitro-, 98⁷.
- C₁₁H₂₄O Hendecyl alcohol, 4142⁷, 5074⁹.
 3-Heptanol, 3-isopropyl-2-methyl-, 2420³.
- C₁₁H₂₄O₂ Formaldehyde, di-tertiary amyl acetal, 2420³.
- C₁₁H₂₄S Sulfide, decyl methyl, 4670¹.
 C₁₁H₂₄As Arsenic, diisoamylmethyl-, 120⁷.
 C₁₁H₂₄AsCl₃ Arsenic, diisoamylmethyl-, dichloride, 120⁷.
- C₁₁H₂₄N Hendecylamine, and -HCl, 2419².
- C₁₁H₂₄N₂O Propionaldehyde, β -dipropylamino-, dimethyl acetal, 3209³.
- C₁₁H₂₄NO₂ Propionaldehyde, β , β' -methylimino-bis-, bis(dimethyl acetal), 3209³.
- C₁₁H₂₄N₂ Guanidine, diisoamyl-, P 154⁷.
- C₁₁H₂₄N₂O₂S₂ Methionamide, *N*, *N'*-diamyl-, 98⁷.
- C₁₁H₂₄Fe₂N₂ See Barium ferricyanide.
 C₁₁Co₂N₂O₁₂ + 9H₂O, 4904⁸.
 C₁₁Cu₂N₂H₂ + 10H₂O, 2674¹.
 C₁₁Fe₂K₂N₂O₁₂ + 20H₂O, 4905¹.
 C₁₁Fe₂K₂N₂O₁₂, 4905¹.
 C₁₁Fe₂N₂O₁₂ + 24H₂O, 4904⁹.
 C₁₁Fe₂N₂ See Iron ferricyanide.
- C₁₁H₂₄Br₂O₄ 1, 1' - Bi[cyclohexene] - 4, 4', 6, 6' - tetrone, 3, 3, 3', 3', 5, 5, 5', 5'-octabromo-, 1401⁸.
- C₁₁H₂₄Br₂O₄ Compd., m. 228-9⁹, from rhodo-(bromo)-resorquinone, 1401⁷.
 Rhodo-(bromo)-resorquinone, 1401⁸.
- C₁₁H₂₄Br₂O₄S₂ 2, 3, 6, 7 - Thianthrenetetrol, 1, 4, 5, 8-tetrabromo-, disulfone, 3468².
- C₁₁H₂₄Cl₂N₂O₂ Ether, 4-chloro-2, 5-dinitrophenyl 2, 4-dichloro-5-nitrophenyl, 2957⁷.
- C₁₁H₂₄AsBr₂N Phenarsazine, 1, 3, 5, 7, 9-pentabromo-1, 6-dihydro-, 3709⁹.
- C₁₁H₂₄Br₂O₂ Naphthalic anhydride, bromo-, 2435^{3,7}.
- C₁₁H₂₄Br₂O₂ Naphthalic anhydride, bromohydroxy-, 2435⁴.
- C₁₁H₂₄Br₂O₄S₂ 2, 3, 6, 7-Thianthrenetetrol, 1, 4, 5-tribromo-, disulfone, 3468².
- C₁₁H₂₄Cl₂O₂ Naphthalic anhydride, chloro-, 2435^{3,7}.
- C₁₁H₂₄Cl₂O₂S Naphthalic anhydride, 3-(chlorosulfonyl)-, 2435⁴.
- C₁₁H₂₄Cl₂N₂O₂ Ether, 2, 4-dichloro-5-nitrophenyl 2, 4-dinitrophenyl, 2957⁷.
- C₁₁H₂₄Cl₂N₂O₂ Ether, 4-chloro-2-nitrophenyl 2, 4-dichloro-5-nitrophenyl, 2957⁷.
- C₁₁H₂₄Cl₂N₂O₂ Ether, 4, 5-dichloro-2-nitrophenyl 2, 4-dichlorophenyl, 2957⁷.
- C₁₁H₂₄Cl₂N Diphenylamine, 2, 2', 4, 4', 6, 6'-hexachloro-(2), 2952⁴.
- C₁₁H₂₄N₂O Naphthalic anhydride, nitro-, 3463⁴.
- C₁₁H₂₄Hexatriene, phenyl-, 2931¹.
- C₁₁H₂₄AsBr₂N₂O Phenarsazinic acid, 3, 5, 7, 9-tetrabromo-, 3709⁹.
- C₁₁H₂₄Br₂N₂O Naphthalimide, 2-bromo-, 2435⁷.
- C₁₁H₂₄Br₂ClNO₂ Indophenol, 2, 6-dibromo-3'-chloro-, 3450⁸.
- C₁₁H₂₄Br₂N₂O₂S₂ Disulfide, bis(4-bromo-2-nitrophenyl), 4450⁸.
- C₁₁H₂₄Br₂N₂O₂ Indophenol, tribromo-, 3450⁸.
- C₁₁H₂₄Br₂N₂ Azobenzene, 2, 2', 5, 5'-tetrabromo-, 4456⁴.
- C₁₁H₂₄Br₂N₂O Azoxybenzene, tetrabromo-, 2171⁸, 4456⁴.
- C₁₁H₂₄Br₂O₄ 4, 4'-Biresorcinol, 2, 2', 6, 6'-tetra-bromo-, 1401⁸.
- C₁₁H₂₄ClNO₂ Naphthalimide, chloro-, 2435^{3,7}.
- C₁₁H₂₄Cl₂N₂O₂S₂ Sulfide, bis(4-chloro-2-nitrophenyl), 1629⁸.
- C₁₁H₂₄Cl₂N₂O₂S₂ Disulfide, bis(chloronitrophenyl), 1629⁸, 4459⁴.
- C₁₁H₂₄Cl₂N₂O₂ Ether, 2, 4-dichlorophenyl 2, 4-dinitrophenyl, 2957⁷.
- C₁₁H₂₄Cl₂N₂O₂S₂ Sulfoxide, bis(4-chloro-2-nitrophenyl), 1629⁸.
- C₁₁H₂₄Cl₂N₂O₂ Biphenyl, 2, 3, 5-trichloro-4'-nitro-, 822⁷.
 Indophenol, trichloro-, 3450⁷, 3451⁸.
- C₁₁H₂₄Cl₂N₂O₂ Ether, chloronitrophenyl dichlorophenyl, P 2188⁷, 2957⁷.
 Ether, *p*-chlorophenyl 4, 5-dichloro-2-nitrophenyl, 2957⁷.
- C₁₁H₂₄Cl₂Hg Benzene, 1, 1'-mercuribis[2, 5-dichloro-, 5172⁷.
- C₁₁H₂₄Cl₂N₂O₂ Biphenyl, 4, 4'-diiodo-3, 3'-dinitro-, 2170⁸.
- C₁₁H₂₄N₂O₂S 1, 3, 6-Thioheptadiazine, 4, 5-naphthylene-2, 7-endoxy-, 2953⁴.
- C₁₁H₂₄N₂O₂ Dibenzofuran, 3, 6-dinitro-, 2182³.
- C₁₁H₂₄N₂O₂S₂ Disulfide, bis(2, 4-dinitrophenyl), 4459⁴.
- C₁₁H₂₄O₂ Acenaphthenequinone, 2964⁴.
- C₁₁H₂₄O₂S 2, 3-Thiophanthrenequinone, 3470⁸.
- C₁₁H₂₄O₂ Naphthalic anhydride, hydroxy-, 2435^{3,7}.

- $C_{12}H_8O_4Pb_3S_6$ Resorcinol, trimercapto-, Pb deriv., 8261.
- $C_{12}H_8O_4$ Naphthalic anhydride, 3,4-dihydroxy-, 4212².
- $C_{12}H_7AsClN_2O_4$ Phenarsazine, 1 chloro-1,6-dihydro 3,9-dinitro-, 4474².
- $C_{12}H_7BrOS$ 3-*peri*-Naphthothiopyranol, bromo-, P 1418².
- 3(2) - *peri* - Naphthothiopyrone, bromo-, P 2723².
- $C_{12}H_7BrNO_2$ Indophenol, 2,6-dibromo-, 3450².
- $C_{12}H_7BrNO_2$ 3,4-Quinaldinedicarboxylic acid, 6,8-dibromo-, P 4951².
- $C_{12}H_7BrNO_2S$ Phenolsulfonic acid, (3,5-dibromo-4-keto-*p*-phenyldieneamino)-, Na salt, 3450², 3451².
- $C_{12}H_7Br_2N$ Diphenylamine, tetrabromo-, 3709².
- $C_{12}H_7Br_2N_2$ Triazene, 1,3-bis(2,5-dibromophenyl)-, 4450².
- $C_{12}H_7ClN_2O_4$ Azobenzene, 5-chloro-2,4-dinitro-, 118².
- $C_{12}H_7Cl_2NO_2$ Biphenyl, dichloronitro-, 822² Indophenol, dichloro-, 3277², 3150².
- $C_{12}H_7Cl_2NO_2$ Ether, 5-chloro-2-nitrophenyl 4-chlorophenyl, P 2188².
- Ether, 4,5-dichloro-2-nitrophenyl phenyl, 2957².
- $C_{12}H_7Cl_2NO_2$ Phenol, 2,6-dichloro-4-(2,4-dinitroamino)-, 3911².
- $C_{12}H_7Cl_2$ Biphenyl, trichloro-, 822².
- $C_{12}H_7Cl_2NO_2$ Aniline, 2,4,6-trichloro-, picrat, 2428².
- $C_{12}H_7Cl_2O$ Ether, *p*-chlorophenyl 2,4-dichlorophenyl, 2957².
- $C_{12}H_7Cl_2N$ Diphenylamine, tetrachloro-, 2952².
- $C_{12}H_7Cl_2NO_2$ Aniline, 4,5-dichloro-2-(2,4-dichlorophenoxy)-, 2957².
- $C_{12}H_7NO_2$ 4,5-Benzquinoline 2,3-dione, P 613².
- Naphthostyryl, formyl-, P 2417².
- $C_{12}H_7NO_2S$ 2- β -Naphthisothiazolecarboxylic acid, 3470².
- $C_{12}H_7N_2O_2$ 2,3-Quinoxalinedicarboximide, N-acetyl-, 3473².
- $C_{12}H_7N_2O_2$ Biphenyl, trinitro-, 2962².
- $C_{12}H_7$ *p*-Diphenylene, 129².
- $C_{12}H_7As_2Br_2$ Arsenobenzene, *p*, *p'*-dibromo-, 3677².
- $C_{12}H_7As_2Br_2O$ *p*-Arsenophenol, 3,3'-dibromo-, 3677².
- $C_{12}H_7BrCl$ Biphenyl, 4-bromo-4'-chloro-, 2961², 2962².
- $C_{12}H_7BrClN$ Azobenzene, bromochloro-, 823², 824².
- $C_{12}H_7BrClO_2S$ Sulfone, *p*-bromophenyl *p*-chlorophenyl, 2962².
- $C_{12}H_7BrNO_2$ Indophenol, bromo-, 3450².
- Quinonimine, 2-bromo-N-salicyl-, 3450².
- $C_{12}H_7BrN_2O_2$ Azobenzene, *p*-bromo-*p'*-nitro-, 4406².
- $C_{12}H_7BrN_2O_2$ Azoxybenzene, *p*-bromo *p'*-nitro-, 4406².
- $C_{12}H_7Br_2O_2S$ 2,3,6,7-Thianthrene-tetrol, merquinoid bromide, 3468².
- $C_{12}H_7Br_2Hg$ Benzene, 1,1'-mercuribis[4-bromo-, 5172².
- $C_{12}H_7Br_2N_2$ Azobenzene, 3,5-dibromo-, 824².
- $C_{12}H_7Br_2NO_2$ Azoxybenzene, dibromo-, 2171².
- $C_{12}H_7Cl$ Biphenyl, 4-chloro-4'-iodo-, 2961².
- $C_{12}H_7ClN$ Carbazole, 2-chloro-, P 4483².
- $C_{12}H_7ClNO_2$ Indophenol, 2-chloro-, 3450².
- Nicotinic acid, 5-chloro-, Ph ester, 838².
- Picolinic acid, 4-chloro-, Ph ester, 838².
- $C_{12}H_7ClNO_2$ Ether, 5-chloro-2-nitrophenyl phenyl, P 2188².
- $C_{12}H_7ClN_2O_2$ Azobenzene, chloronitro-, 823².
- $C_{12}H_7ClN_2O_2S$ *p*-Nitrobenzenediazonium *p*-chlorobenzenesulfonate, P 614².
- $C_{12}H_7ClO_2S_2$ 2,3,6,7-Thianthrene-tetrol, merquinoid chloride, 3468².
- $C_{12}H_7ClO_2S_2$ 2,3,6,7-Thianthrene-tetrol, merquinoid perchlorate, 3468².
- $C_{12}H_7Cl_2N_2$ Azobenzene, *p*, *p'*-dichloro-, 823².
- $C_{12}H_7Cl_2NO_2$ Azoxybenzene, dichloro-, 823², 2171².
- Phenol, 2,6-dichloro-4-phenylazo-, 824².
- $C_{12}H_7Cl_2OS$ Acetyl chloride, (chloro-1-naphthylmercapto)-, P 2989².
- $C_{12}H_7Cl_2N$ Diphenylamine, 2,4,6-trichloro-, 2952².
- $C_{12}H_7Cl_2NO$ Aniline, chloro(dichlorophenoxy)-, P 2044², P 2188².
- $C_{12}H_7Hg_2$ Benzene, 1,1'-mercuribis[4-iodo-, 5172².
- $C_{12}H_7Hg_2NO_2$ Benzene, 1,1'-mercuribis[4-nitro-, 5172².
- $C_{12}H_7I_2NO_2$ 3,4-Quinaldinedicarboxylic acid, 6-iodo-, P 4951².
- $C_{12}H_7I_2$ Biphenyl, *p*, *p'*-diiodo-, 129².
- $C_{12}H_7NO$ Phenoxazine, 4468².
- $C_{12}H_7N_2$ Phenazine, 4468².
- $C_{12}H_7N_2OS$ Naphthisothiazolecarboxamide, 3470².
- $C_{12}H_7N_2O_2$ Naphthalimide, N-amino-, 4214².
- $C_{12}H_7N_2O_2S_2$ 2th Thianthreneamine, 7-nitro-, 3468².
- $C_{12}H_7NO_2$ Ketone, nitrophenyl pyridyl, 2976².
- $C_{12}H_7NO_2$ Biphenyl, dinitro-, 2962².
- $C_{12}H_7NO_2S$ Naphthalimide, 3-sulfamyl-, 2435².
- $C_{12}H_7NO_2S_2$ Disulfide, bis(nitrophenyl), 4459².
- Hydroquinone, bis(thiocyanoacetate), 4930².
- Pyrocatechol, bis(thiocyanoacetate), 4930².
- Resorcinol, bis(thiocyanoacetate), 4930².
- $C_{12}H_7NO_2$ 1,2-Pyran-4-carboxylic acid, 3,6-dihydro-2,3,6-triketo-, 3-phenylhydrazine, 1879².
- $C_{12}H_7NO_2S$ Benzenesulfonic acid, *p*-nitro-, nitrophenyl ester, 830².
- $C_{12}H_7NO_2$ Biphenyl, tetrahydroxydinitro-, 3219².
- $C_{12}H_7NO_2$ Azobenzene, *p*, *p'*-dinitro-, 4406².
- $C_{12}H_7NO_2$ Azoxybenzene, *p*, *p'*-dinitro-, 4406².
- Phenol, *p*-(2,4-dinitrophenylazo)-, 4679².
- $C_{12}H_7NO_2$ *o*-Biphenylamine, 3,4',5-trinitro-, 830².
- $C_{12}H_7O_2$ Dibenzofuran, 2181², 2182², 2439², 3494², 3697².
- $C_{12}H_7OS$ 3-*peri*-Naphthothiopyranol, P 1418², P 3933².
- Phenothioxin, 4468².
- $C_{12}H_7OS_2$ Oxidiphenylene disulfide, 3446².
- Thianthrene, 9-oxide, 4468².
- $C_{12}H_7OS_2$ Phenoxaselenin, 4468².
- $C_{12}H_7OS_2$ Selenanthrene, oxide, 4468².
- $C_{12}H_7OTe$ Phenoxatellurin, 4468².
- $C_{12}H_7O_2$ Dibenzodioxin, 4468².
- 1(2)- β -Isonaphthofuranone, P 1724².
- $C_{12}H_7O_2S$ Phenothioxin, S-oxide, 4468².
- $C_{12}H_7O_2S_2$ Thianthrene, 9,10-dioxide, 4468².
- $C_{12}H_7O_2Se$ Phenoxaselenin, oxide, 4468².
- $C_{12}H_7O_2Te$ Phenoxatellurin, oxide, 4468².
- $C_{12}H_7O_2S$ Phenothioxin, 10-dioxide, 2704², 4468².
- $C_{12}H_7O_2S_2$ Thianthrene, 9-dioxide 10-oxide, 4468².
- $C_{12}H_7O_2Te$ Phenoxatellurin, dioxide 4468².
- $C_{12}H_7O_2$ Naphthalic acid, 3468².
- 2-Naphthoic acid, 4-formyl-3-hydroxy-, P 2447².

- C₁₂H₅O₄S₂** Thianthrene, 9,10-tetroxide, 4468¹.
 2,3,6,7-Thianthrenetretol, 3468¹.
C₁₂H₅O₄S₂ 2,3,6,7-Thianthrenetretol, 9-oxide, 3468¹.
C₁₂H₅O₄S₂ Naphthalic acid, 3,4-dihydroxy-, 4212⁸.
C₁₂H₅O₄S₂ 2,3,6,7-Thianthrenetretol, 9,9-di-oxide, 3468².
C₁₂H₅O₄S₂ Naphthalic acid, sulfo-, and Na salt, 2435^{2,4,5}.
C₁₂H₅O₄S₂ 2,3,6,7-Thianthrenetretol, 9,9,10,10-tetroxide, 3468².
C₁₂H₅S₂ Thianthrene, 4468¹.
C₁₂H₅Se₂ Selenanthrene, 4468¹.
C₁₂H₅AsBrN Phenarsazine, 1-bromo-1,6-dihydro-, 3708⁹.
C₁₂H₅AsClN Phenarsazine, chlorodihydro-, P 851⁷, 3708⁹, 3709¹, 3982², 4473³, 4704⁴.
C₁₂H₅AsIN Phenarsazine, 1,6-dihydro-1-iodo-, 3708⁹.
C₁₂H₅BiS₂ Bismuthine, tri-2-thienyl-, 4699².
C₁₂H₅BrN₂ Azobenzene, *p*-bromo-, 4406⁹.
C₁₂H₅BrN₂O Azoxybenzene, *p*-bromo-, 4406⁹.
C₁₂H₅BrN₂O₂ 2,3-Quinoxalinedicarboxylic acid, 6-bromo-, mono-Et ester, 3473⁷.
C₁₂H₅BrO Phenol, *p*-(*p* bromophenyl)-, 2961¹.
C₁₂H₅BrS₂Te Tri-2-thienyltellurium bromide, 4699².
C₁₂H₅Br₂N Aniline, 2,6-dibromo-4-phenylazo-, 824³.
C₁₂H₅ClN₂O₂ 2,3-Quinoxalinedicarboxylic acid, 6-chloro-, mono-Et ester, 3473⁷.
C₁₂H₅ClN₂O₂S Benzenesulfonanilide, 4-chloro-2-nitro-, 1629⁶.
C₁₂H₅ClO Acetonaphthone, α -chloro-, 3703⁹.
 Phenol, *p*-(*p*-chlorophenyl)-, 2961¹.
C₁₂H₅ClO₂S Naphtholsulfonyl chloride, acetate, 3909⁴.
C₁₂H₅Cl₂I Biphenyl, 4-iodo-, dichloride, 2170⁶.
C₁₂H₅Cl₂N *o*-Biphenylamine, 3',5'-dichloro-, 822⁷.
 Quinoline, 2-(γ , γ -dichloropropenyl)-, 4218⁴.
 Xenylamine, 3',5'-dichloro-, 822⁷.
C₁₂H₅Cl₂NO Aniline, chloro-2-(*p*-chlorophenoxy)-, P 2188³, 2957⁵.
C₁₂H₅Cl₂N₂O Ether, 2-amino-4-chlorophenyl 5-amino-2,4-dichlorophenyl, 2957⁵.
C₁₂H₅Cl₂ Biphenyl, iodo-, 2170⁶, 3909⁷.
C₁₂H₅IO Phenol, *p*-(*p*-iodophenyl)-, 2961¹.
C₁₂H₅N See *Carbazole*.
C₁₂H₅NO Carbazolol, P 4483¹.
 2-Naphthonitrile, 3-(hydroxymethyl)-, P 1724².
C₁₂H₅NO₂ Acenaphthene, nitro-, P 4950³.
 Biphenyl, nitro-, 2962¹.
 1,8-Carbazolediol, P 3715⁴.
 Indophenol, 3450³.
 Quinonimine, *N*-salicyl-, 3450³.
C₁₂H₅NO₂S 2-Carbazolesulfonic acid, P 4483¹.
C₁₂H₅NO₂ Acid, m. 141°, from compd., m. 92-3°, 4218⁷.
 Ether, *o*(and *p*)-nitrophenyl phenyl, 4460⁴.
C₁₂H₅NO₂ 1-Naphthoic acid, 4-nitro-, Me ester, 2463³.
C₁₂H₅NO₂S 2-Furanmethylmercaptan, *p*-nitrobenzoate, P 155¹.
C₁₂H₅NO₂S Benzenesulfonic acid, *p*-nitro-, Ph ester, 830⁹.
 Cinchoninic acid, 3-(carboxymethylmercapto)-1,2-dihydro-2-keto-, 2443².
C₁₂H₅N₂S Phenothiazine, 4468¹.
C₁₂H₅N₂Se Phenoselenazine, 4468¹.
C₁₂H₅N₂O 2,1,3-Benzotriazole, 2-(*p*-hydroxyphenyl)-, 836⁴.
C₁₂H₅N₂O Azobenzene, *p*-nitro-, 4406⁹.
 2,1,3-Benzotriazole, 2-(2,4-dihydroxyphenyl)-, 836⁴.
 Carbazole, 3-aminonitro-, 3226³.
C₁₂H₅N₂O₂ Azoxybenzene, *p*-nitro-, 4406⁹.
 Phenol, *p*-(nitrophenylazo)-, 3158⁹, 4679⁸.
 —, 2-nitro-4-phenylazo-, 4406⁹.
C₁₂H₅N₂O₂ *o*-Biphenylamine, 3,5-dinitro-, 830⁴.
 Phenol, 2-nitro-4-phenylazoxy-, 4406⁹.
 Xenylamine, 2,6-dinitro-, 830⁴.
C₁₂H₅N₂ Compd. from PhNH₂ and trimer of H₂C(CN)₃, 1114⁴.
C₁₂H₅O₂S₂ 2,3,6,7-Thianthrenetretol, meri-quinoid sulfate, 3468².
C₁₂H₅Se See *Acenaphthene*; *Biphenyl*.
C₁₂H₅AsCl Arsine, chlorodiphenyl-, 3982².
C₁₂H₅AsN₂O₂ 1,2,3-Benzotriazole-5-arsonic acid, 1-phenyl-, 2954³.
C₁₂H₅AsN₂O₂ 1,2,3-Benzotriazole-5-arsonic acid, 1-*p*-hydroxyphenyl-, 2954³.
C₁₂H₅AsBr₂N Aniline, 4,4-arsenobis(bromo-, 3677¹.
C₁₂H₅AsBr₂N₂O₂ *p*-Arsenophenol, 3,3'-diamino-5,5'-dibromo-, 3677¹.
C₁₂H₅As₂O₂ Phenol, *p*, *p*'-arsenobis-, 4940².
C₁₂H₅BrNO Aniline, *p*-(*p*-bromophenoxy)-, 4460⁷.
C₁₂H₅Br₂N Benzidine, 2,6-dibromo-, 824³.
 Hydrazobenzene, 3,5-dibromo-, 824³.
C₁₂H₅ClNO Aniline, 4-chloro-2-phenoxy-, P 2188³.
C₁₂H₅ClN₂ Aniline, 2-chloro-4-phenylazo-, 824³.
C₁₂H₅Cl₂ $\Delta^{1,2}$ -Cyclohexadiene, 1,3-dichloro-5-phenyl-, 822⁷.
 Naphthalene, 1,5-dichloro-2,6-dimethyl-, P 613³.
C₁₂H₅Cl₂Si Silicane, dichlorodiphenoxy-, 4457⁴.
C₁₂H₅Cl₂Pb Plumbane, dichlorodiphenyl-, 5470⁹.
C₁₂H₅Cl₂Sn Stannane, dichlorodiphenyl-, 5172².
C₁₂H₅FeI₂N₂O₂ 353³.
C₁₂H₅Hg Mercury diphenyl, 2158⁹, 2424¹, 2955⁵, 5172⁷.
C₁₂H₅HgI Diphenyliodonium iodide, HgI₂ salt, 3214¹.
C₁₂H₅HgI₂N Benzenediazonium iodide, HgI₂ salt, 3214¹.
C₁₂H₅HgO₂S Acetic acid, naphthylmercapt-mercapto-, 3982⁷.
C₁₂H₅I Diphenyliodonium iodide, 3214¹.
C₁₂H₅I Diphenyliodonium triiodide, 1614².
C₁₂H₅NNa Diphenylamine, Na deriv., P 1418⁹.
C₁₂H₅N₂ (See also *Azobenzene*.)
 Carbazole, 1-amino-, P 3715⁴.
 Phenazine, 5,10-dihydro-, 4468¹.
C₁₂H₅N₂O Azoxybenzene, 337⁴, 2171³, 3908⁹, 4406⁹.
 Diphenylamine, nitroso-, 4423⁷, 5043².
 3-Indolepropionitrile, β -keto-2-methyl-, 3928².
 Phenol, *p*-phenylazo-, 2428⁹, 3158⁹, 4406⁹, 5470⁸.
C₁₂H₅N₂O₂S *p*-Naphthothiazole, 2-amino-4-methoxy-, P 5328².
C₁₂H₅N₂O₂ *o*-Biphenylamine, 5-nitro-, 830⁴.
 Phenol, *p*, *p*'-azobis-, 4406⁹.
 —, *p*-phenylazoxy-, 4199³, 4406⁹.
 Pyridine, 3-*p*-nitrobenzyl-, and -HNO₂, 2978¹.
C₁₂H₅N₂O₂ Phenol, *p*, *p*'-azobis-, 4406⁹.
 Pyrazolecarboxylic acid, acetylphenyl-, 1637⁷.
C₁₂H₅N₂O₂ Diacetanilide, 2-cyano-4,6-methylenedioxy-, 1404⁹.

- $C_{12}H_{11}N_2O_5S$ Benzenesulfonic acid, *p*-(*p*-hydroxyphenylazo)-, 5470^a.
- 3-Hydantoinacetic acid, 5-salicylal-2-thio, 820^a.
- 1-Phenol-2-sulfonic acid, 5-phenylazo-, 3679^a.
- $C_{12}H_{11}N_2O_5$ Acetophenone, α , diarsp - 3, 4 - dihydroxy-, diacetate, 826^a.
- Glycine, *N*-(*N*-phthalylglycyl)-, 169^a.
- 3-Hydantoinacetic acid, 5-salicylal-, 820^a.
- $C_{12}H_{11}N_2O_5S$ Phenylsulfuric acid, *p*-(2,4-dihydroxyphenylazo)-, *K* salt, 2160^a.
- $C_{12}H_{11}N_2O_5S$ Phenylsulfuric acid, *o*, *o'*-azobis-, di-*K* salt, 2160^a.
- $C_{12}H_{11}N_2O_5S$ 1,3,6-Carbazoletrisulfonic acid, 8-amino-, P 3715^a.
- $C_{12}H_{11}N_2S$ 2,7-Thianthrene diamine, and *FeCl* compd., 3468^a.
- $C_{12}H_{11}N_4$ 2,1,3 - Benzotriazole, aminophenyl, 836^a.
- $C_{12}H_{11}N_2O_5S$ 2,1,3 - Benzotriazole - 2 - *p* - benzenesulfonic acid, 5-amino-, 836^a.
- $C_{12}H_{11}N_2O_5S$ Aniline, 2,2'-thiobis[5-nitro-, 3468^a.
- $C_{12}H_{11}N_2O_5S$ Aniline, 2,2'-dithiobis[5-nitro-, 3468^a.
- $C_{12}H_{11}N_2O_5$ Quinolinesulfonic acid, dinitro-, Et ester, 1904^a, 3228^a.
- $C_{12}H_{11}N_2O_7$ *m*-Cresol, 2,4,6-trinitro-, pyridine compd., 4207^a.
- $C_{12}H_{11}N_2O_5$ Pyridine, 2-methylnitrosoamino-, picrate, 837^a.
- $C_{12}H_{11}O$ Acetonaphthone, 4467^a.
- Phenyl ether, 318^a, 3697^a.
- $C_{12}H_{11}O_5S$ Isophenyl sulfoxide, 2704^a.
- Phenol, phenylmercapto-, 2956^a.
- $C_{12}H_{11}O_2$ 1,4-Pyrone, 2-methyl-6-phenyl-, and salts, 142^a, 143^a.
- $C_{12}H_{11}O_2S$ Acetic acid, 1-naphthylmercapto-, P 2989^a.
- Isophenyl sulfone, 2704^a.
- $C_{12}H_{11}O_2S$ Naphthoic acid, methoxy-, P 2190^a.
- $C_{12}H_{11}O_2S$ Phenol, *p*-(phenylsulfonyl)-, 2956^a.
- $C_{12}H_{11}O_2$ (See also *Quinhydrone*.)
- Piperic acid, 2432^a.
- $C_{12}H_{11}S$ Isophenyl sulfide, 2703^a.
- Phenyl sulfide, 36^a, 2703^a.
- $C_{12}H_{11}AgN_2O_5$ Malonanilic acid, α -cyano-, Et ester, Ag deriv., 4193^a.
- $C_{12}H_{11}AsN_2O_5$ Arsanilic acid, 3-nitro-*N*-phenyl-, 2954^a.
- $C_{12}H_{11}AsN_2O_5$ Arsanilic acid, *N*-(*p*-hydroxyphenyl)-3-nitro-, 2954^a.
- $C_{12}H_{11}AsN_2O_5$ 3-Pyridinecarboxylic acid, 6-(*p*-nitrobenzalhydrazino)-, 1641^a.
- $C_{12}H_{11}BrN_2O$ 3(2)-Cyclopentapyrazolone, 2-(*p*-bromophenyl) - 1,4,5,6 - tetrahydro-, P 613^a.
- $C_{12}H_{11}BrO_5$ 2,1-Benzopyran-1,3(4)-dione, 5-bromo - 7,8 - dimethoxy - 4 - methyl -, 842^a.
- $C_{12}H_{11}BrO_5$ Piperonal, 6-bromo-, hydrate, diacetate, 4204^a.
- $C_{12}H_{11}BrN_2O_5$ Acetoacetic acid, α -(2,4,6-tribromophenylazo)-, Et ester, 824^a.
- Glyoxylic acid, Et ester, acetyl(2,4,6-tribromophenyl)hydrazone, 824^a.
- $C_{12}H_{11}Cl$ Naphthalene, chloro-2,6-dimethyl-, P 613^a.
- $C_{12}H_{11}ClN$ Benzidine, 3-chloro-, 824^a.
- $C_{12}H_{11}ClN_2O$ Cinchonamide, 2-chloro-*N*, *N*-dimethyl-, P 1217^a.
- $C_{12}H_{11}ClN_2O_5$ Carbazole, 6-chloro-1,2,3,4-tetrahydronitro-, 139^a.
- $C_{12}H_{11}ClN_2O_5S$ Benzenesulfonic acid, 4-chloro-2-nitro-, *PhNH* salt, 4459^a.
- $C_{12}H_{11}ClO_2$ α , γ -Pentadienyl chloride, δ -*p*-ansyl-, 3912^a.
- 1,4-Pyrone, 2-methyl-6-phenyl-, -HCl, 143^a.
- $C_{12}H_{11}ClO_5S$ Phenyl-*p*-phenylidenesulfonium perchlorate, 2703^a.
- $C_{12}H_{11}ClO_5$ Acetophenone, α -chloro-3,4-dihydroxy-, diacetate, 826^a.
- $C_{12}H_{11}ClO_5$ Piperonal, 6-chloro-, hydrate, diacetate, 4204^a.
- $C_{12}H_{11}ClN$ Quinoline, 2-(γ , γ -dichloropropyl)-, 4218^a.
- $C_{12}H_{11}Cl_2NO$ 2-Quinolinesethanol, α -(dichloromethyl)-, 4218^a.
- $C_{12}H_{11}Cl_2NO$ Succinimide, *N*-(2,6-dichloro-*p*-phenetyl)-, 3910^a.
- $C_{12}H_{11}Cl_2N_2O_5$ Acetoacetic acid, α -(2,4,6-trichlorophenylazo)-, Et ester, 824^a.
- Glyoxylic acid, Et ester, acetyl(2,4,6-trichlorophenyl)hydrazone, 824^a.
- $C_{12}H_{11}Cl_2NO_5$ 1,3-Benzodioxan, 6-acetamido-2,4-bis(dichloromethyl)-, 2975^a.
- $C_{12}H_{11}HgNO_5$ Quinoline, (acetoxymethyl)-methyl-, 839^a.
- $C_{12}H_{11}IS$ Phenyl-*p*-phenylidenesulfonium iodide, 2704^a.
- $C_{12}H_{11}MoN_2O_5$ 2898^a.
- $C_{12}H_{11}N$ (See also *Diphenylamine*.)
- Acenaphthenamine, P 4950^a.
- 2,1 - *peri* - Benzisoquinoline, 2,3 - dihydro -, 1634^a.
- Pyridine, benzyl-, 2973^a, -HNO₃, 2976^a.
- $C_{12}H_{11}NO$ Aniline, phenoxy-, P 2188^a, 4460^a.
- $C_{12}H_{11}NOS$ Benzenesulfonamide, 4460^a.
- $C_{12}H_{11}NO_2$ Cinnamic acid, α -cyano-, Et ester, 4463^a.
- 1-quinoline, 1-ethyl-6,7-methylenedioxy-, 2444^a.
- Naphthamide, methoxy-, P 2188^a, P 2190^a.
- Phenol, *p*, *p'*-iminobis-, 3450^a.
- Phthalimide, *N*- Δ^2 -butenyl-, 4931^a.
- 8-Pyrrolopyridine, 1,3-diacyetyl-, 4217^a.
- $C_{12}H_{11}NO_2$ Acetic acid, benzoylciano-, Et ester, 4463^a.
- Crotonic acid, α -anisalamino- β -hydroxy-, lactone, 3676^a, 3677^a.
- Dibenzofuran, 1,2,3,4 - tetrahydronitro -, 2439^a.
- 3-Indolepropionic acid, β -keto-2-methyl-, and salts, 3928^a.
- $C_{12}H_{11}NO_3$ Cinnamic acid, 5 - cyano - 2,3 - dimethoxy-, 2166^a.
- 3-Indolepropionic acid, 2-carboxy-, 834^a.
- 1-Indoleacetic acid, 2,3 diketo-, Et ester, 2970^a.
- $C_{12}H_{11}NO_5$ Pyrocatechol, 4-(β -nitrovinyl)-, diacetate, 5162^a.
- Rotenic acid, nitro-, 601^a.
- $C_{12}H_{11}NO_5$ Piperonal, 6-nitro-, hydrate, diacetate, 4204^a.
- $C_{12}H_{11}N_2NaO_5$ See *Sodium phenobarbital*.
- $C_{12}H_{11}N_2$ Aniline, *p*-phenylazo-, 4406^a, -HCl, 4200^a.
- Carbazole, diamino-, 3226^a.
- $C_{12}H_{11}N_2O$ Aniline, *p* phenylazoxo-, 4406^a.
- $C_{12}H_{11}N_2O_5$ Biuret, 1-(1-naphthyl)-, 3442^a.
- $C_{12}H_{11}N_2O_5S$ 1,3,4 - Thiodiazolid - 2 - one, 3,4 - diacyetyl-5 phenylamino-, 2974^a.
- $C_{12}H_{11}N_2O_5$ Naphthylamine, *N*, *N* - dimethyl-dinitro-, 4466^a, 4467^a.
- Quinolinesulfonic acid, nitro-, Et ester, 1904^a, 3227^a.
- $C_{12}H_{11}N_2NaO_5$ 2 - Pyrazinol, 3,6 - dimethyl - 5 - phenylazo-, *Na* deriv., 3472^a.

- C₁₂H₁₁N₅O₅ Urea, ethylnitro (nitroquinoly)-, 1903³, 3227⁷.
- C₁₂H₁₁N₅O₅ 2 - Imidazolecarboxylic acid, Et ester, picrate, 1638⁹.
- C₁₂H₁₁O₅P Phosphoric acid, di-Ph ester, *Ba salt*, 2418⁸.
- C₁₂H₁₂ Naphthalene, dimethyl-, 3697⁴.
- C₁₂H₁₅AsN Arsenamide, diphenyl-, 3678⁹.
- C₁₂H₁₂AsN₂ Aniline, *p, p'* - arsenobis -, *di-HCl*, 4940¹.
- C₁₂H₁₂AsN₂O₃ Benzenearsonic acid, 3,3'-azoxybis[4-hydroxy-, 4940¹.
- C₁₂H₁₂BiKNaO₃ Tartaric acid, bismuth potassium sodium complex, P 1648⁴.
- C₁₂H₁₂BrN Benzylpyridinium bromide, 1330¹.
- 2 - Naphthylamine, 1 - bromo - *N, N* - dimethyl-, P 606².
- C₁₂H₁₂BrNO₄ 1,2 - Indandione, 4 - bromo - 6,7 - dimethoxy - 3 - methyl -, 2 - oxime, 842⁹.
- C₁₂H₁₂BrO 2 - Pentanone, 4 - methyl - 4 - phenyl-, tetra-Br deriv., 4461⁵.
- C₁₂H₁₂BrO₂ Valeric acid, *δ - p* - anisyl - *α, β, γ, δ*-tetrabromo-, 3912¹.
- C₁₂H₁₂CdN₁₀, 1587¹.
- C₁₂H₁₂ClN Benzylpyridinium chloride, 1330¹, 1902¹.
- Carbazole, 6 - chloro - 1,2,3,4 - tetrahydro -, 130⁹.
- 2 - Naphthylamine, 1 - chloro - *N, N* - dimethyl-, P 606².
- C₁₂H₁₂ClO₃ 1,3 - Benzodioxan - 6 - sulfonic acid, 2,4 - bis(dichloromethyl)-, Et ester, 2975⁷.
- C₁₂H₁₂NNaO₄ See *Salysan*.
- C₁₂H₁₂N₂ (See also *Benzidine*.)
- o, o'*-Bianiline, 6456⁹.
- Hydrazobenzene, 3445⁷.
- Phenylenediamine, phenyl-, sulfate, 1820³; *ZnCl₂ salt*, P 2722⁴.
- C₁₂H₁₂N₂O₂ Cincunoninamide, 2-ethoxy-, P 1217⁴.
- Naphthylamine, *N, N* - dimethylnitro -, 4466⁴.
- 4,7 - Phenanthroline - 3,8(4,7) - dione, 1,2,9,10 - tetrahydro -, 125⁴.
- Pyrazolecarboxylic acid, 4 - phenyl -, Et ester, 3704⁷.
- Quinolinecarbamie acid, Et ester, 1903³, 3228⁷.
- C₁₂H₁₂N₂O₂ (See also *Phenobarbital*.)
- Δ^1 - 5 - Pyrazolecarboxylic acid, 1 - acetyl - 3-phenyl-, 3704⁸.
- C₁₂H₁₂N₂O₃ Thiazole, 2 - (acetamidomethyl) 4^o - (3,4 - dihydroxyphenyl) -, -HCl, 3470⁴.
- C₁₂H₁₂N₂O₃ 1 - Phenol - 2 - sulfonic acid, 5 - (*p*-aminoanilino)-, 3679⁷.
- C₁₂H₁₂N₂O₃ Hydantoinacetic acid, hydroxybenzyl-, 820⁹, 3443⁹.
- C₁₂H₁₂N₂O₃ 3,3' - Biphenol, 6,6' - diamino -, bis(hydrogen sulfate), and *di-K salt*, 2161¹.
- C₁₂H₁₂N₂ (See also *Intramix*.)
- o*, *o'*-Dithiobis-, 3446¹.
- C₁₂H₁₂N₂O 2 - Pyrazinol, 3,6 - dimethyl - 5 - phenylazo-, 3472⁴.
- C₁₂H₁₂N₂O₂ Benzoxazole, 1 - (diacetylguanido) -, 4449³.
- C₁₂H₁₂N₂O₂ Pyridine, 2 - α - methylhydrazino -, picrate, 837⁷.
- C₁₂H₁₂N₂O₂ + 10H₂O, 2674³.
- C₁₂H₁₂O Dibenzofuran, 1,2,3,4 - tetrahydro -, 2429⁴.
- Δ^1 - 2 - Hexadecene, 6 - phenyl -, P 3477³.
- α, γ - Pentadienaldehyde, α - methyl - δ phenyl-, P 3714².
- C₁₂H₁₂O₅ Phenyl - *p* - phenyldenesulfonium hydroxide, 2703⁹.
- C₁₂H₁₂O₂ 2 - Naphthol, 3,6 - bis(methylmercaptq)-, 1129⁹.
- C₁₂H₁₂O₂ α, γ - Pentadienaldehyde, $\delta - p$ - anisyl-, 3911⁹.
- C₁₂H₁₂O₂ Benzoic acid, 3916⁹.
- Glutaric anhydride, α -benzyl-, 2710³.
- Herniarin, 5,8-dimethyl-, 1894⁴.
- Δ^1 - 2,4 - Hexenedione, 6 - (*m* - hydroxyphenyl)-, 4211⁵.
- 2 - Indanpropionic acid, 1 - keto -, 2710³.
- α, γ - Pentadienic acid, $\delta - p$ - anisyl -, 3912¹, 34⁴.
- C₁₂H₁₂O₃ Naphthalenesulfonic acid, Et ester, 2160¹.
- Thiochromone, 2,3 - dimethoxy - 6 - methyl -, 2441¹.
- Thiocoumarin, 3,4 - dimethoxy - 6 - methyl (?), 2441¹.
- C₁₂H₁₂O₄ Coumarin, ethoxymethoxy-, 2718⁵.
- Rotenic acid, 601³.
- Tubaic acid, 382⁴, 601⁴.
- Valerolactone peroxide, δ -salicyl-, 2430⁴.
- C₁₂H₁₂O₄ Acid, m. 98.5°, from tubaic acid Me ether, 382⁷.
- 2,1 - Benzopyran - 1,3(4) - dione, 7,8 - dimethoxy 4 - methyl -, 843¹.
- Cinnamaldehyde, dimethoxymethylene dioxy-, 4940⁷.
- Coumarin, ethoxyhydroxymethoxy-, 2719⁵.
- Isocoumarin, 5,6,7 - trimethoxy -, 3699⁹.
- C₁₂H₁₂O₄ 1,2 - Benzopyran - 3 - acetic acid, 3,4 - dihydro - 3 - hydroxy - 4 - keto 7-methoxy-, 4480⁹.
- 2,1 - Benzopyran - 1,3(4) - dione, 5,6,7 - trimethoxy-, 3699⁹.
- 1,3,5 - Cyclohexanetrione, 2,4,6 - triacetyl-, 1403⁴.
- Malonic acid, (*m* - carboxybenzyl)methyl-, 138².
- C₁₂H₁₂O₄ 1,4 - Pyrone, 2 - methyl - 6 - phenyl -, sulfate, 143¹.
- C₁₂H₁₂O₅ 1,5 - Naphthalenedisulfonic acid, di-Me ester, 2160¹.
- C₁₂H₁₂O₅ Protocatechuic acid, 5 - methoxy -, diacetate, 3914⁴.
- C₁₂H₁₂O₅Th + 9H₂O, 2119⁴.
- C₁₂H₁₂S₂ Naphthalene, bis(methylmercaptol), 135⁷, 1634⁴.
- C₁₂H₁₂AsN₂O₄ Benzenearsonic acid, 3 - amino - 4-anilino-, and -HCl, 2954¹.
- C₁₂H₁₂AsN₂O₄ Benzenearsonic acid, 3 - amino - 4 - *p* - hydroxyanilino -, 2954¹.
- C₁₂H₁₂AsN₂O₄ 3 - Pyridinearsonic acid, 6 - (*p*-aminobenzalhydrizino) -, 1641¹.
- C₁₂H₁₂BrO₃ 1 - Indanone, 4 - bromo - 6,7 - dimethoxy - 3 - methyl -, 842⁹.
- C₁₂H₁₂BrO₄ Phthalic acid, 4 - bromo -, di Et ester, 3457⁹.
- C₁₂H₁₂BrO₄ Hemipic acid, 6 - bromo -, di Me ester, 4222⁹.
- C₁₂H₁₂ClN₂ Pyrimidine, 6 - chloro - 1 - ethyl - 1,4 - dihydro - 2 - phenyl -, -HCl, 810⁷.
- C₁₂H₁₂ClN₂O₄ Compd. from beardine and HClO₄, 2119⁴.
- Cyclohexane, (4 - chloro - 2,5 - dimethoxyphenyl)-, 2047⁹.
- C₁₂H₁₂ClO₄ Hydrotubaic acid, chloro -, 382⁴.
- C₁₂H₁₂ClN₂ Quinolone, 2 - (γ, γ - dichloropropenyl) - 1,2,3,4 - tetrahydro -, 4218⁵.

- C₁₂H₁₁Cl₂NO₂ *p* - Diacetophenetide, 2,6 - dichloro-, 1629¹, 1630¹, 3910².
- C₁₂H₁₁FO₄ Phthalic acid, 4-fluoro-, di-*l*-*l*t ester, 3457².
- C₁₂H₁₁N 1 - Naphthylamine, *N,N* - dimethyl -, 2964¹.
- Quinoline, trimethyl-, P 2185¹.
- C₁₂H₁₁NO 2 - Naphthylamine, 1 - ethoxy -, P 2188¹.
- 8 - Pyrrolopyridine, 1 - methyl - 3 - propionyl-, 4217¹.
- C₁₂H₁₁NOS 1,3,4 - Thiazine, 6 - ethoxy - 2 - phenyl-, 840².
- C₁₂H₁₁NO₂ Isoquinoline, 6,7 - dimethoxy - 1 - methyl-, 2444¹.
- Isoquinoline, 1 - ethyl - 3,4 - dihydro - 6,7 - methylenedioxy-, 2444².
- C₁₂H₁₁NO₂S Acetic acid, (6 - cyano - *α* - pseudo - cumylmercapto)-, P 715¹.
- Acetic acid, thiocyno-, phenylpropyl ester, 4930².
- C₁₂H₁₁NO₂ 2 - Indanpropionic acid, 1 - keto -, oxime, 2710¹.
- Quinaldic acid, 1 - acetyl - 1,2,3,4 - tetrahydro-, 1411².
- C₁₂H₁₁NO₂ 1,2 - Indandione, 5,6 - dimethoxy - 3 - methyl -, 2 - oxime, 842².
- Isocarbostyryl, 5,6,7 - trimethoxy -, 3699².
- C₁₂H₁₁NO₂ Cinnamaldehyde, dimethoxymethylenedioxy -, oxime, 4940².
- C₁₂H₁₁NO₂ Cinnamic acid, 2,3 - dimethoxy - 5-nitro-, Me ester, 2166².
- C₁₂H₁₁NO₂ Protocatechuyl alcohol, *α* - (nitro-methyl) -, 3,4 - diacetate, 5162¹.
- C₁₂H₁₁NO₂ Syringic acid, nitro-, Me ester, acetate, 1405¹.
- C₁₂H₁₁N₃ Benzenetriamine, phenyl-, 3347².
- C₁₂H₁₁N₂O Urea, *α*-ethylquinolyl-, 1903², 3227².
- C₁₂H₁₁N₂OS Δ¹ - 1 - Pyrazolincarboxamide, *N* - ethyl - 5 - keto - 3 - phenylthio -, 388¹.
- Δ¹ - 1 - Pyrazolincarboxy - *p* - toluidine, 5 - keto - 3 - methylthio -, 388².
- C₁₂H₁₁N₂O₂S 1,3,4 - Thiodiazolid - 2 - one, 4 - acetyl - 5 - xylylimino -, 2074².
- C₁₂H₁₁N₂O₂ Creatinine, 5 - (4 - hydroxy - 3 - methoxybenzyl)-, 5469¹.
- C₁₂H₁₁N₂O₂ Rhamnolactone, 5 - keto -, *p* - nitrophenylhydrazone, 1884².
- C₁₂H₁₁N₂O₂S Flavianic acid, MeNH deriv., 4702².
- C₁₂H₁₁ Benzene, 1 - allyl - 4 - propenyl -, 3908².
- Benzene, *p*-diallyl-, 3908¹.
- , *p*-dipropenyl-, 3908².
- Cyclohexene, 1-phenyl-, 4937¹.
- C₁₂H₁₁AsNO₂ Phenylthioarsinous acid, 5 - acetamido - 2 - hydroxy -, dithiocarbonylmethyl ester, 3677².
- C₁₂H₁₁AsN₂O₂ Benzenearsonic acid, 3 - amino - 4-(*p*-aminoanilino)-, 2954¹.
- C₁₂H₁₁BrNO₂ 1 - Indanone, 4 - bromo - 6,7 - dimethoxy - 3 - methyl -, oxime, 842².
- C₁₂H₁₁Br₂N₂O₂ Compd. from benzidine and HBrO₂, 2118¹.
- C₁₂H₁₁Br₂O₂ Divaric acid, 3,5 - dibromo -, Et ester, 1632¹.
- C₁₂H₁₁Br₂ Benzene, *p* - bis(dibromopropyl) -, 3908².
- Benzene, 1 - (*α,β* - dibromopropyl) - 4 - (*β,γ* - dibromopropyl) -, 3908¹.
- C₁₂H₁₁ClNO₂ Cyclohexane, (4 - chloro - 3 - nitrophenyl) -, 2947².
- C₁₂H₁₁CINO₂ Tyrosine, *N* - chloroacetyl -, Me ester, 2196¹.
- C₁₂H₁₁ClN₂O₂ Cyclohexanone, chloronitrophenylhydrazone, 139².
- C₁₂H₁₁CuN₂ Pyrrole, 2 - (methyliminomethyl) -, Cu deriv., 4698².
- C₁₂H₁₁NO₂ Compd. from benzidine and HIO₃, 2118¹.
- C₁₂H₁₁N₂O 3 - Pyrazolone, 1 ethyl - 5 - methyl - 2 phenyl-, 4701¹.
- 3 - Pyrazolone, trimethylphenyl-, 4701².
- 4(3) - Pyrimidone, 3 - ethyl - 5,6 - dihydro - 2-phenyl-, 840².
- Quinoline, 8 - amino - 6 - isopropoxy -, P 851¹.
- C₁₂H₁₁N₂OS Benzothiazole, 3,5 - dimethyl - 1 - methylanilino -, acetyl deriv., 3705².
- Benzothiazoline, 1 - imino - 2,3,5 - trimethyl-, acetyl deriv., 3705¹.
- C₁₂H₁₁N₂O₂ 1,3,4,6 - Oxadiazin - 5(4) - one, 6 - ethyl - 2 - methyl - 4 - phenyl -, 1904¹.
- 1,3,4,6 - Oxadiazin - 5(4) - one, 2 - isopropyl - 4 phenyl -, 145².
- , 2,6,6 - trimethyl - 4 - phenyl -, 1904².
- Δ¹ - 3 - Pyrazolincarboxylic acid, 4 - phenyl -, Et ester, 3704².
- C₁₂H₁₁N₂OS Thiazole, 2 - (*α* - aminoisopropyl) - 4 - (3,4 - dihydroxyphenyl) -, *HCl*, 3470².
- C₁₂H₁₁N₂O₂ Caproic acid, *γ,δ* - diketo -, *γ* - phenylhydrazone, 101².
- Homoveratronic acid, 2 - acetamido -, 5177².
- C₁₂H₁₁N₂O₂S 2 - Naphthalenesulfonic acid, 7 - (*β*-aminoethylamino)-, P 848¹.
- Naphthionic acid, *N* - (*β* - aminoethyl) -, P 848¹.
- C₁₂H₁₁N₂O₂ Asparagine, *N*^α-*m*-toluyl-, 1620².
- Cyclohexane, (2,4 - dimethylphenyl) -, 2947².
- Glycine, *N*-hippuryl -, Me ester, 603².
- Norpinic acid, 1,3 - dicyano -, di - Me ester, 1398².
- C₁₂H₁₁N₂O₂S 1 - Naphthol - 3 - sulfonic acid, 7 - (*β* - aminoethylamino) -, P 848¹.
- C₁₂H₁₁N₂O₂ Asparagine, *N*^α-*am*-toluyl-, 1620².
- C₁₂H₁₁N₂O₂ 2 - Chromanol, 2,4,4 - trimethyl - 3 - dimethyl -, 4471².
- 3 - Pentanol, 3,5 - dinitrobenzoate, 2420².
- C₁₂H₁₁N₂O₂S 1 - Naphthol - 3,6 - disulfonic acid, 7 - (*β* - aminoethylamino) -, P 848¹.
- C₁₂H₁₁N₂ Ketone, methyl 2-pyrryl, azine, 5183².
- C₁₂H₁₁N₂O₂ Bicyclo[3.1.1] - 6 - azaheptane, perate, 1131².
- C₁₂H₁₁N₂S 5 - Triazole, 3 - (*β* - allylthiocarbamido)-5-anilino -, 2177².
- 1,2,4 - Triazole, 3(or 5) - (*β* - allylthiocarbamido) - 5(or 3) - amino - 1 - phenyl -, 2178¹.
- C₁₂H₁₁O Anisole, cyclopentenyl-, 4689².
- Cinnamaldehyde, *α* - isopropyl -, P 3714².
- Δ¹ - 3 - Hexenone, 1 - phenyl -, 3696².
- 1 - Indanone, 3,4,6 - trimethyl -, P 1416¹.
- Phenol, cyclohexenyl-, 4689².
- C₁₂H₁₁O Benzene, *p*-bis(allyloxy) -, 2705².
- Δ¹ - 2 - Butenol, 4 - phenyl -, acetate, 2948².
- Cinnamaldehyde, *α* - ethyl - *p* - methoxy -, P 3714².
- Cyclohexanone, 2-phenoxy-, 2430¹.
- Cyclopentanecarboxylic acid, Ph ester, 4454².
- Ketone, cyclopentyl salicyl-, 4455².
- Naphthaldehyde, tetrahydromethoxy-, P 2446².
- Phenol, *p* - isobutenyl -, acetate, 4689².

- C₁₂H₁₄O₂ Carbonic acid, allyl phenethyl ester, 1247.
 Cinnamic acid, *p*-ethoxy-, Me ester, 1396.
 —, *p*-propoxy-, 1396.
 Cinnamic alcohol, ester with Et acid carbonate, 1247.
 Desoxyhydrotubaic acid, 382.
 5-*m*-Dioxanol, 2-styryl-, 1403.
 1,3-Dioxolane - 4 - carbinol, 2 - styryl -, 1403.
 1 - Indanone, 5,6 - dimethoxy - 3 - methyl -, 842.
 Pentenic acid, δ -*p*-anisyl-, 3912.
 Propionic acid, α -benzoyl-, Et ester, 4463.
 C₁₂H₁₄O₂ Apiole, 4940.
 Benzenediacetic acid, di-Me ester, 137.
 Benzoic acid, α -(*o*-carboxybutyl)-, 137.
 1,3 - Butanedione, 1 - (3,4 - dimethoxyphenyl)-, 125.
 Cinnamaldehyde, 3 - methoxy - 4 - (methoxymethoxy)-, 3906.
 Cinnamic acid, 3,4 - dimethoxy - β - methyl -, 842.
 Dillapiole, 2712.
 Dillisoapiole, 2712.
 5 - *m* - Dioxanol, 2 - methyl -, benzoate, 1875.
 1,3 - Dioxolane - 4 - carbinol, 2 - methyl -, benzoate, 1875.
 Hydrocinnamic acid, carboxy -, di-Me ester, 137, 138.
 Isoapiole, 599.
 Phthalic acid, di-Et ester, P 154, 1348, 1793, 2081, 5006.
 Pyrocatechol, dipropionate, 2161.
 Terephthalic acid, diethyl ester, 2081.
 C₁₂H₁₄O₂ Compd. μ m. 72-6°, from NaOH and 5,6,7-trimethoxyisocoumarin, 3699.
 Terephthalic acid, 2,6 - dimethoxy -, di-Me ester, 1126.
 C₁₂H₁₄O₂ Homophthalic acid, 4,5,6 - trimethoxy-, 3699.
 Malic acid, α - {(*m* - methoxyphenoxy)-methyl}-, and *Ca salt*, 4480, 4481.
 C₁₂H₁₄AsN₂O₂ Phenylthioarsinous acid, 4 - carbamylmethylamino -, di(carboxymethyl)ester, 3677.
 C₁₂H₁₄AsN₂O₂ 1,4 - Benzisoxazin - 6 - arsonic acid, 5 - acetamido - 2 - ethyl - 3 - hydroxy-, 842.
 C₁₂H₁₄AsN₂O₂ Acetic acid, (2,6 - diacetamido - 4-arsenophenoxy)-, 841.
 C₁₂H₁₄Br Cyclohexane, (*p*-bromophenyl)-, 2947.
 C₁₂H₁₄BrN₂O Hydrazine, β - acetyl - α - (α -bromobutyl)- α - phenyl -, 1904.
 Hydrazine, α - bromoacetyl - β - isobutyl - α -phenyl-, 145.
 C₁₂H₁₄BrN₂O Cyclohexylamine, 3-bromo-, picrate, 1121.
 C₁₂H₁₄BrO Hydrocinnamic acid, 2 - bromo - 4,5 - dimethoxy - β - methyl -, 842.
 C₁₂H₁₄Cl Cyclohexane, (*p* - chlorophenyl) -, 2947.
 C₁₂H₁₄ClN₂O γ -Chloroallyltrimethylammonium picrate, 2150.
 C₁₂H₁₄ClO₂ 2 - Pentanol, 4 - chloro -, benzoate, 602.
 C₁₂H₁₄ClN Quinoline, 2 - (γ,γ - dichloropropyl) - 1,2,3,4 - tetrahydro -, 4318.
 C₁₂H₁₄ClN₂O Rhamnose, 2,4,6 - trichlorophenylhydrazones, 4679.
 C₁₂H₁₄ClN₂O Fructose, 2,4,6 - trichloro-~~phenylhydrazones~~, 4679.
 Galactose, 2,4,6 - trichlorophenylhydrazones, 4679.
 Glucose, 2,4,6 - trichlorophenylhydrazones, 4679.
 C₁₂H₁₄Cl₃O₂ Parabutylchloral, 817.
 C₁₂H₁₄Cu₂N₂Rh₂ + 5H₂O, 2674.
 C₁₂H₁₄HgN₂O₂ Acetophenone, *m* - (acetoxy-mercuriamino)-, acetate, 1121.
 C₁₂H₁₄I Cyclohexane, (*p*-iodophenyl)-, 2947.
 C₁₂H₁₄N Quinaldine, 1 - ethyl - 1,2 - dihydro -, P 2185.
 Xenylamine, 2',3',4',5' - tetrahydro and -HCl, 4687.
 C₁₂H₁₄NO Acetanilide, *p*-isobutenyl-, *m*-Acetotoluide, 4-isopropenyl-, 468.
 Benzoic acid, piperidine, 1282.
 α -Hexananilide, 964.
 Pentenanilide, methyl-, 964.
 C₁₂H₁₄NO₂ Acetoacetoxyliide, 835.
 α -Acetotoluide, 5 - propionyl-, 4457.
 Cinnamamide, *p* - propoxy -, 1398.
 Cyclohexane, (nitrophenyl)-, 2947.
 2 - Indolinol, 1 - acetyl - 3,3 - dimethyl -, 3927.
 Isoquinoline, 3,4 - dihydro - 6,7 - dimethoxy 1-methyl-, 2444.
 —, 7 - ethoxy - 3,4 - dihydro - 6 - methoxy -, and *salts*, 4227.
 p -Levulinotoluide(?), 4193.
 Valeric acid, γ - hydroxy - γ - *p* - toluino -, γ -lactone(?), 4193.
 C₁₂H₁₄NO₂ β - Alanine, *N* - thiobenzoyl -, Et ester, 840.
 C₁₂H₁₄NO₂ 1 - Indanone, 5,6 - dimethoxy - 3 - methyl-, oxime, 842.
 2 - Indolecarboxylic acid, 4,5,6,7 - tetrahydro - 4 - keto - 3,6,6 - trimethyl -, 2716.
 Isocarbostyryl, 7 - ethoxy - 3,4 - dihydro - 6-methoxy-, 3230.
 Isovalerophenone, 4 - methyl - 3 - nitro -, 4457.
 Valerophenone, 4 - methyl - 3 - nitro -, 4457.
 C₁₂H₁₄NO₂ (See also *Cotarnine*.)
 Benzene, 4 - allyl - 1 - ethoxy - 2 - methoxy - 7-nitro-, 1123.
 2 - Chromanol, 2,4,4 - trimethyl - 6 (and 7) - nitro-, 4471.
 5 - *m* - Dioxanol, 2 - methyl -, carbanilate, 1875.
 1,3 - Dioxolane - 4 - carbinol, 2 - methyl -, carbanilate, 1875.
 Hydrocinnamic acid, β - amino - α - ethyl - 3,4 - methylenedioxy -, -HCl, 1892.
 —, β - dimethylamino - 3,4 - methylenedioxy -, -HCl, 1892.
 Malonic acid, (α -ethylaminobenzyl)-, 1892.
 C₁₂H₁₄NO₂ Protocatechyl alcohol, α - (amino-methyl)-, 3,4 - diacetate, 5162.
 C₁₂H₁₄NO Propanol, dimethoxy -, *p* - nitrobenzoate, 4445.
 3 - Pyrrolepropionic acid, 2,5 - dicarboxy - 4 - methyl -, mono - Et ester, 1133.
 C₁₂H₁₄N₂O₂ 2 - Naphthalenesulfonic acid, 4 - amino - 8 - (β - aminomethylamino), P 845.
 C₁₂H₁₄N₂O₂ ϵ - Triazine, 2,4,6 - tris(acetonyl mercapto)-, 1021.
 C₁₂H₁₄O₂ 1,3 - Butanedione, 1 - phenyl - dimethylthallium deriv., 2423.
 C₁₂H₁₄ Cyclohexane, phenyl-, P 611, 2947, 4936.

- 2 - Pentene, 4 - methyl - 4 - phenyl - (?), 4461⁵.
- C₁₂H₁₁AsCl Arisine, chlorocyclohexylphenyl -, 120⁹.
- C₁₂H₁₁AsNO₂ Xanthic acid, (*p* - aminophenyl-arylene) deriv., P 1649⁷.
- C₁₂H₁₁AsN₂O₂ Phenylthioarsinous acid, acetamidohydroxy-, di(carbamylmethyl) ester, 3678¹.
- C₁₂H₁₁BrIO₇ Glucose 1 - bromo - 6 - iodohydrin, triacetyl -, 1064¹.
- C₁₂H₁₁BrNO Acetanilide, 3 - bromo - 4 - *tert* - butyl-, 115⁴.
- Benzamide, *N* - ϵ - bromoamyl-, 1617¹.
- C₁₂H₁₁BrNO₂ 2 - Pyrrolecarboxylic acid, 4 - acetyl - 5 - (bromomethyl) - 3 - ethyl -, Et ester, 2184⁴.
- C₁₂H₁₁Br₂N₂O₄ Rhamnose, (2,5 - dibromophenyl)hydrazone, 1400⁴.
- C₁₂H₁₁Br₂N₂O₄ Galactose, (2,5 - dibromophenyl)hydrazone, 1400⁴.
- d* - Glucose, (3,5 - dibromophenyl)hydrazone, 1400⁴.
- C₁₂H₁₁Br₂O₄ 1,3 - Cyclohexanedicarboxylic acid, 1,3 - dibromo - 2 - keto -, di-Et ester, 4678¹.
- C₁₂H₁₁ClN₂O₄ Rhamnose, 2 - chloro - 4 - nitrophenylhydrazone, 4679⁹.
- C₁₂H₁₁ClN₂O₄ Fructose, 2 - chloro - 4 - nitrophenylhydrazone, 4679⁹.
- Galactose, 2 - chloro - 4 - nitrophenylhydrazone, 4679⁹.
- Glucose, 2 - chloro - 4 - nitrophenylhydrazone, 4679⁹.
- C₁₂H₁₁Cl₂Hg₂O₂ Resorcinol, bis(chloromercuri) - 4-hexyl-, 1401¹.
- C₁₂H₁₁Cl₂N₂O₄ Rhamnose, 2,4 - dichlorophenylhydrazone, 4679⁹.
- C₁₂H₁₁Cl₂N₂O₄ Fructose, 2,4 - dichlorophenylhydrazone, 4679⁹.
- Galactose, 2,4 - dichlorophenylhydrazone, 4679⁹.
- Glucose, 2,4 - dichlorophenylhydrazone, 4679⁹.
- C₁₂H₁₁INOS 5 - Ethoxy - 2 - ethyl - 1 - methylbenzothiazolium iodide, 1900⁷.
- C₁₂H₁₁I₂O₇ Glucose, aceto - 1,6 - diiodo -, 106¹.
- C₁₂H₁₁N₂O Indoline, 1 - acetyl - 2 - amino - 3,3-dimethyl-, 3927⁴.
- C₁₂H₁₁N₂O₂ Aniline, 4 - cyclohexyl - 3 - nitro -, 2947¹.
- Benzamide, *N* - (β - ethylcarbamylethyl) -, 840¹.
- Indole, 3 - (β - aminoethyl) -, acetate, 834¹.
- C₁₂H₁₁N₂O₂ Acetanilide, *tert*-butylnitro-, 115⁴, 2952⁹.
- Acetoacetic acid, α, α - bis(β - cyanoethyl) -, Et ester, 834¹.
- Asparagine, *N* ^{α} -xylyl-, 4674¹.
- Barbituric acid, 5 - cyclohexenyl - 5 - ethyl -, P 483¹.
- , (ethylpropyl)-, propargyl-, P 933⁷.
- Carbamic acid, (β - benzamidoethyl)-, Et ester, 2183¹.
- C₁₂H₁₁N₂O₄ Aniline, *N* - amyl - 4,5 - methylenedioxy - 2 - nitro -, 4204¹.
- Asparagine, *N* ^{α} -phenetyl-, 4674¹.
- p* - Benzenedipropionic acid, 2,3 - diamino -, *Na* salt, P 2988⁷.
- Propionic acid, β, β' - (3,6 - diamino - *o* - phenylene)bis-, 123⁹.
- 2,5 - Pyrazinedicarboxylic acid, 3,6 - dimethyl-, di-Et ester, 6024¹.
- C₁₂H₁₁N₂O₄ *p* - Toluenesulfonic acid, 3 - nitro -, piperidine, 2957⁵.
- C₁₂H₁₁N₂O₂ Butyrophene, 4 - methyl - 3 - nitro-, semicarbazone, 4457¹.
- C₁₂H₁₁N₂O₄ α - Hydroxyallyltrimethylammonium picrate, 2150⁷.
- C₁₂H₁₁N₂S₂ Piperazine, 1,4 - bis(4,5 - dihydro - 5 - methylene - 2 - thiazyl)-, 2178¹.
- C₁₂H₁₁N₂S₂ Δ^2 - 5 - Thiazolineacetonitrile, 2,2' - (ethylenedimino)bis-, 2177⁴.
- C₁₂H₁₁O Acetophenone, 5 - isopropyl - 2 - methyl-, 2431³.
- Acetophenone, trimethyl-, 3339¹.
- Anisole, butenylmethyl-, 4690¹.
- , *p*-cyclopentyl-, 4689⁹.
- Benzyl alcohol, α - ethyl - β - propenyl -, 3908⁹.
- Caprophenone, 4440⁹.
- Δ^1 - Cyclohexeneacrolein, 4 - isopropenyl -, 2248¹, 4942².
- Ether, cyclohexyl phenyl, P 1908⁷, 4937¹.
- , ethyl isobutenylphenyl, 1890¹.
- Ethylene oxide, α, α - diethyl - β - phenyl -, 2958⁷.
- Hydratropaldehyde, isopropyl-, P 1649⁸.
- 2 - Pentanone, 4 - methyl - 4 - phenyl -, 4461⁵.
- Phenol, cyclohexyl, P 1908⁷, P 2540⁴, 4689⁹, 4937¹.
- C₁₂H₁₁O₂ Anisaldehyde, 2 - isopropyl - 5 - methyl-, 1123¹.
- Benzene, 4 - allyl - 1 - ethoxy - 2 - methoxy -, 1890¹.
- , 1 - ethoxy - 2 - methoxy - 4 - propenyl -, 1890¹.
- Benzoic acid, Am ester, 3938⁹, isoamyl ester, 217¹.
- 2 - Chromanol, 2,4,4 - trimethyl-, 4471⁸.
- 1,2 - Cyclohexanediol, 1 - phenyl -, 2095⁹, 2701⁸.
- Δ^1 - Cyclohexeneacrylic acid, *p* - isopropenyl-, 2247¹, 4942².
- Hydrocinnamic acid, β, β - dimethyl -, Me ester, 4461⁵.
- Phenol, *p*-butyl-, acetate, 4690¹.
- C₁₂H₁₁O₂ Anisic acid, 2 - isopropyl - 5 - methyl-, 1123¹.
- 2 - Benzofurancarboxylic acid, 3,4,5,6 - tetrahydro - 1 - methyl -, Et ester, 2710⁸.
- Benzyl alcohol, α - ethyl -, ethylcarbonate, 1872¹.
- Furanacrylic acid, Am ester, 3993⁷.
- Isomyrystinol, 1123⁷.
- Myristinol, 1123⁷.
- Salicylic acid, Am ester, 3938⁹.
- C₁₂H₁₁O₄ Acetophenone, ethoxydimethoxy -, 14037⁴.
- Benzoic acid, ethoxyethylmethoxy -, 2979⁸, 3217⁴.
- Cyclohexanemalononic acid, 1 - (β, β - dihydroxypropyl)-, dilactone, 3672⁷.
- Homoveratric acid, 6-ethyl-, 843¹.
- Hydrocinnamic acid, 3,4 - dimethoxy - β -methyl-, 842⁹.
- Isoxylic acid, 4,6 - dimethoxy -, Me ester, 1894⁵.
- Δ^1 - 1 - Propenol, 3 - [3 - methoxy - 4 - (methoxymethoxy)phenyl], 2983⁹.
- Rhizonic acid, Et ester, 1894⁴.
- C₁₂H₁₁O₄ Anisic acid, diethoxy-, 1403⁴, 2718⁷.
- 3,4 - Furandicarboxylic acid, 2,5 - dimethyl-, di-Et ester, 3926⁹.

- Malonic acid, (2 - furylmethyl) -, di-Et ester, 5472¹.
- C₁₂H₁₈O₄ 1,4 - Cyclohexanedicarboxylic acid, 2,3 - diketo -, di-Et ester, 4677².
- Glucoside, phenyl-, 106¹, 821¹, 1881⁴.
- C₁₂H₁₈O₇ Arbutin, 2501⁴.
- Galactoside, β - *p* - hydroxyphenyl -, 5176⁴.
- C₁₂H₁₈O₈ Anhydrofructose, triacetyl -, 3907².
- Galactosan < α , 1,5 > < β , 1,6 >, 2,3,4 - triacetyl -, 3669⁹.
- Glucose 1,2 - anhydride, 3,4,6 - triacetyl -, 1881⁴.
- Levogluconan, triacetyl -, 4196⁴.
- C₁₂H₁₈O₈ 2 - *p* - Cymenecarboxylic acid, diethio -, Me ester, 115⁴.
- C₁₂H₁₇AsN₂O₃ Benzenearsonic acid, 4 - hydroxy -, 3,5 - bis(propionylamino) -, 1400⁹.
- C₁₂H₁₇BrN₂O₃ Altromethyllose, *p* - bromophenylhydrazone, 2940¹.
- C₁₂H₁₇ClN₂ *p* - Phenylenediamine, 2 - chloro - 5 - cyclohexyl -, 2947⁴.
- C₁₂H₁₇ClN₂O₇ Triethylamine, β - chloro -, picrate, 92¹.
- C₁₂H₁₇ClO₄ *d* - Glucose, α - 1 - chloro - 2,3,4 - triacetyl -, 4196⁴.
- C₁₂H₁₇HgNO₂ Aniline, *p* - (acetoxymethyl) -, *N*, *N* - diethyl -, 1888⁹.
- C₁₂H₁₇IN₂ Ethylpropylbenzimidazolium iodide, 1637².
- C₁₂H₁₇IO₃ Glucose 6 - iodohydrin, β - triacetyl -, 106⁴.
- C₁₂H₁₇N Aniline, *p* - butenyl - *N*, *N* - dimethyl -, 4689².
- Aniline, *p* - cyclohexyl -, 2947⁴.
- , *p* - isobutenyl - *N*, *N* - dimethyl -, 4689².
- , *N* - methyl - *N* - α - methyl - Δ^2 - butenyl -, P 3052⁷.
- Benzylamine, *N* - α - methyl - Δ^2 - butenyl -, P 3052⁷.
- Cyclohexylamine, *N* - phenyl -, and -HCl, 111².
- Naphthylamine, *N* - ethyltetrahydro -, P 2987⁴, P 3717⁴.
- Piperidine, benzyl -, 2975⁹.
- C₁₂H₁₇NO Acetanilide, *m* - *tert* - butyl -, 2952⁹.
- Isovalerophenone, 3 - amino - 4 - methyl -, and -HCl, 4457².
- 2 - Pentanone, 4 - methyl - 4 - phenyl -, oxime, 4461⁴.
- Valerophenone, 3 - amino - 4 - methyl -, and -HCl, 4457².
- C₁₂H₁₇NO₂ Aniline, allylethoxymethoxy -, 1124¹.
- Benzyl alcohol, α - (dimethylaminomethyl) -, acetate, 4269⁴.
- Hydrocinnamic acid, *o* - dimethylamino -, Me ester, 126².
- , *o* - (ethylmethylamino) -, and -HCl, 126².
- 3 - Indolecarboxylic acid, 4,5,6,7 - tetrahydro - 2 - methyl -, Et ester, 2715⁹.
- Isoquinoline, 7 - ethoxy - 1,2,3,4 - tetrahydro - 6 - methoxy -, and -HCl, 4227².
- 3 - Pentanol, 1 - phenyl -, carbamate, P 3470⁹.
- Phenethyl alcohol, β - dimethylamino -, acetate, and -HCl, 4269⁴.
- Pyrrole, 8 - acetyl - 4 - ethyl - 2 - methyl - 5 - propionyl -, 2184⁴.
- C₁₂H₁₇NO₂ *p* - Toluenesulfonic acid, piperidide, 2957⁹.
- C₁₂H₁₇NO₃ Acetamide, *N* - (3,4 - dimethoxyphenethyl) -, 2443⁹.
- Formamide, *N* - (4 - ethoxy - 3 - methoxyphenethyl) -, 4227¹.
- Homopiperonyl alcohol, α - (dimethylamino-methyl) -(?), and -HCl, 4683⁹.
- Piperonyl alcohol, α - (α - ethylaminoethyl) -, and -HCl, 2162^{3,4}.
- 1 - Propanol, 2 - dimethylamino - 3 - (3,4 - methylenedioxyphenyl) -(?), and -HCl, 4683⁹.
- C₁₂H₁₇NO₄ 2 - Pyrrolecarboxylic acid, 4 - acetyl - 3 - ethyl - 5 - (hydroxymethyl) -, Et ester, 2184⁴.
- C₁₂H₁₇NO₅ *p* - Acetophenetide, *N* - (ethylsulfonyl) -, 2704⁴.
- C₁₂H₁₇N₂O₃ 2 - Butanone, 4 - *p* - anisyl - 4 - hydroxy -, semicarbazone, 4687².
- Veratraldehyde, 6 - ethyl -, semicarbazone, 843¹.
- C₁₂H₁₇N₂O₇ Malonic acid, [α - (tetrahydro - 2,5 - diketo - 1 - imidazoly)acetamidol] -, di-Et ester, 2154⁹.
- C₁₂H₁₇N₂O₈ 2(1) - *s* - Triazone, 4 - (*p* - dimethylaminophenyl)tetrahydro - 6 - imino -, formate, 4221¹.
- C₁₂H₁₇N₂O₈ *s* - Triazine, 2,4,6 - tris(acetonil mercapto) -, dioxime, 102¹.
- C₁₂H₁₈ Benzene, hexamethyl -, 135¹, 5389⁹, 5469⁹.
- 5,7-Dodecadiene, 2930⁹.
- Hexane, 1-phenyl -, 4440⁴.
- C₁₂H₁₈BeO₂ 2,4-Hexanedione, Be deriv., 2424¹.
- C₁₂H₁₈BrHgN Aniline, *p* - (bromomethyl) -, *N*, *N* - dipropyl -, 1889¹.
- C₁₂H₁₈BrNO₂ 2 - Pyrrolecarboxylic acid, 5 - (bromomethyl) -, 3,4 - diethyl -, Et ester, 2184⁴.
- C₁₂H₁₈BrNO₃ Trimethyl (phenylcarbamylcarbamylmethyl)ammonium bromide, 3023¹.
- C₁₂H₁₈BrN₂O₃ Histidine, *N* - (α - bromoisocaproyl) -, 2904⁴.
- C₁₂H₁₈BrN₂S Piperazine, 1,4 - bis[5 - (bromomethyl) - 4,5 - dihydro - 2 - thiazyl] -, and di-HCl, 2178¹.
- C₁₂H₁₈ClHgN Aniline, *p* - (chloromethyl) -, *N*, *N* - dipropyl -, 1889¹.
- C₁₂H₁₈CoO₂ 2,4 - Hexanedione, Co deriv., P 606⁹.
- C₁₂H₁₈CuO₂ Acetoacetic acid, thiol, Et ester, Cu deriv., 2930⁹.
- C₁₂H₁₈HgIN Aniline, *p* - (iodomethyl) -, *N*, *N* - dipropyl -, 1889¹.
- C₁₂H₁₈MoO₃ Molybdenyl bispropionylacetone, 1877⁴.
- C₁₂H₁₈N₂ *m* - Phenylenediamine, 4 - cyclohexyl -, 2947⁴.
- C₁₂H₁₈N₂O₅ Urea, α - (γ - methoxybutyl) - β - phenylthio -, 4669⁹.
- C₁₂H₁₈N₂O₃ 3 - Indazolecarboxylic acid, 2 - ethyl - 4,5,6,7 - tetrahydro - 4,6 - dimethyl -, 2972⁴.
- 3 - Indazolecarboxylic acid, 4,5,6,7 - tetrahydro - 4,6 - dimethyl -, Et ester, 2972⁴.
- 3 - Isoindazolecarboxylic acid, 1 - ethyl - 4,5,6,7 - tetrahydro - 4,6 - dimethyl -, 2972⁴.
- , 1 - ethyl - 4,5,6,7 - tetrahydromethyl -, Me ester, 2972⁴.
- , 4,5,6,7 - tetrahydro - 1,4,6 - trimethyl -, Me ester, 2972⁴.
- Phenol, (α - dimethylaminoethyl) -, methyl carbamate, and -HCl, 3451⁹, 3452¹.
- Spiro[cyclohexane - 1,4' - piperidine] - 3' - nitrile, 6' - hydroxy - 2' - keto - 6' - methyl -, 3672¹.

- $C_{12}H_{13}N_2O_4$ Altromethylase, phenylhydrazones, 2940⁹.
Aniline, *N* - butyl - 4,5 - dimethoxy - 2 - nitro-, 4204⁹.
 $C_{12}H_{13}N_2O_4S$ Carbamic acid, β - *p* - tolylsulfonamidoethyl-, Et ester, 2183⁹.
 $C_{12}H_{13}N_2O_4$ Malonic acid, *N*, *N'* - vinylenebis-, di-Et ester, 1639⁹.
 $C_{12}H_{13}N_2O_4$ Caffeine, α^1 -butoxy-, P 612³.
Caffeine, α^1 -isobutoxy-, P 612³.
Hydantoin, 3 - [(dihydro - 5 - isopropyl - 3 - methylpyrazolyl)carbonylmethyl] -, 2154⁹.
Xanthine, 8 - ethoxy - 3,7 - diethyl - 1³-methyl-, 3903⁹.
 $C_{12}H_{13}N_4O_5S$ Hexamethylenetetramine, phenol-sulfonate, 41887⁹.
 $C_{12}H_{13}N_4O_5S_2$ Δ^2 - 5 - Thiazolineacetic acid, 2,2' - (ethylenediimino)bis-, 2177⁹.
 $C_{12}H_{13}NiO_4$ 2,4 - Hexanedione, Ni deriv., P 6067.
2,4 - Pentanedione, 3 - methyl -, Ni deriv., P 6067.
 $C_{12}H_{13}O$ Borneol, ethinyl-, 5466¹.
2 - Pentanol, 4 - methyl - 4 - phenyl -, 1461⁹.
 $C_{12}H_{13}O_2$ 1,2 - Butanediol, 2 - ethyl - 1 - phenyl -, 1892².
Resorcinol, hexyl-, 177¹, 630⁹, 1931⁷, P 3717³.
Xylenediol, $\alpha, \alpha, \alpha', \alpha'$ - tetramethyl -, 385¹.
 $C_{12}H_{13}O_2$ Camphor, hydroxy-, acetate, 3693⁹.
 $C_{12}H_{13}O_4$ Acetoacetic acid, α - (2 - ketocyclohexyl)-, Et ester, 2710⁹.
6 - Bicyclo[3.2.0]heptaneacetic acid, 7 - carboxy-, di-Me ester, 1623¹.
 Δ^3 - Cyclohexenecarboxylic acid, 4 - hydroxy - 2 - keto - 6 - propyl -, Et ester, 1632⁹.
Cyclopentaneacetic acid, 2,5 - diketo - $\alpha, \alpha, 3, 3$ - tetramethyl -, Me ester, 1623⁹.
Dimethyl ester, m. 77.5-8°, of acid, m. 232°, 1623².
Spiro[cyclopentane - 1,3'(2') - furan] - 2' - carboxylic acid, 4',5' - dihydro - 5' - keto - 2' - methyl -, Et ester, 110⁹.
 $C_{12}H_{13}O_2Zn$ 2,4 - Hexanedione, Zn deriv., P 606⁹.
 $C_{12}H_{13}O_4$ 1,3 - Cyclohexanedicarboxylic acid, 2 - keto -, di-Et ester, 4678¹.
Cyclohexanemalonic acid, 1 - acetonyl -, 3672^{9,7}.
Galacto - 5,6 - enose, diacetone -, 2940⁹.
 $C_{12}H_{13}O_7$ ψ - Glucal, triacetyldihydro -, 3671¹.
 $C_{12}H_{13}O_8$ Lyxoside, methyl -, triacetate, 102⁹.
 $C_{12}H_{13}BrO_4$ Glucose 6-bromohydrin, diacetone-, 108¹.
 $C_{12}H_{13}ClN_2O$ Trimethyl(*p* - tolylcarbamylmethyl)ammonium chloride, 3023³.
 $C_{12}H_{13}ClN_2O_2$ [(Anisylcarbamyl)methyl]trimethylammonium chloride, 3023³.
 $C_{12}H_{13}ClN_2O_4$ Glycine, *N* - [N - (N - β - chlorobutylglycyl)glycyl] -, 1389¹.
 $C_{12}H_{13}ClO_4$ 1,1,2 - Propanetricarboxylic acid, 1-chloro-, tri-Et ester, 1114⁹.
 $C_{12}H_{13}IO_4$ Glucose 6 - iodohydrin, diacetone -, 108¹.
 $C_{12}H_{13}NO$ Benzyl alcohol, α - (α - ethylamino-propyl)-, and -HCl, 3454⁹.
2 - Butanol, 8 - benzylamino - 2 - methyl -, and salts, 3908⁹.
—, 1 - dimethylamino - 4 - phenyl -, 4260⁷.
Ephedrine, ethyl-, 3982⁹.
Phenethyl alcohol, β - amino - α, α - diethyl-, -HCl, 1892².
 $C_{12}H_{13}NO_2$ Ephedrine, hydroxyethyl, 3982⁹.
2 - Pyroglutamic acid, 3,4 - diethyl - 5-methyl-, Et ester, 2184⁹.
 $C_{12}H_{13}N_2O_4$ Cyclopentanemalonic acid, 1 - acetonyl-, semicarbazone, 3673¹.
 $C_{12}H_{13}P$ Phosphine, phenyldipropyl-, and H_2GCl_4 compd., 4441⁹.
 $C_{12}H_{20}$ Acenaphthene, decahydro-, 4465³.
 $C_{12}H_{20}AsNO_4$ Triglycolarsenic acid, $PhNH_2$ salt, 595⁹.
 $C_{12}H_{20}BrNO$ Trimethyl(γ - phenoxypropyl)-ammonium bromide, 3023³.
 $C_{12}H_{20}ClNO$ [α - (α - Hydroxyethyl)benzyl]trimethylammonium chloride, 4269⁹.
[α - (Hydroxymethyl)phenethyl]trimethylammonium chloride, 4269⁹.
(β - Hydroxymethylphenethyl)trimethylammonium chloride, 4269⁹.
(β - Hydroxy - γ - phenylpropyl)trimethylammonium chloride, 4269⁹.
 $C_{12}H_{20}ClNO_2$ (β -Hydroxy-*p*-methoxyphenethyl)-trimethylammonium chloride, 4269⁹.
 $C_{12}H_{20}ClNO_4$ Leucine, *N* - [N - (N - chloroacetyl)glycyl]glycyl]-, 4232⁹.
 $C_{12}H_{20}INO$ [α - (α - Hydroxyethyl)benzyl]trimethylammonium iodide, 4269⁹.
[α - (Hydroxymethyl)phenethyl]trimethylammonium iodide, 4269⁹.
(β - Hydroxy - α - methylphenethyl)trimethylammonium iodide, 3689⁹.
(β - Hydroxy - γ - phenylpropyl)trimethylammonium iodide, 4269⁹.
(Methoxy - α - methylbenzyl)trimethylammonium iodide, 3451^{9,9}.
 $C_{12}H_{20}N_2$ Hydrazine, α - hexyl - α - phenyl -, -HCl, 4214².
 α -Matrinidin, 2437¹.
 $C_{12}H_{20}N_2O_3$ Anserine, Et ester, chloroplatinate, 4181⁴.
Caproic acid, α - cyano - β - keto - β, β - dimethyl-, Et ester, semicarbazone, 2152⁹.
Histidine, *N* leucyl-, 2991⁹.
 $C_{12}H_{20}N_2O_5S$ Thiasine, 1922¹.
 $C_{12}H_{20}N_2S_2$ Piperazine, 1,4 - bis(4,5 - dihydro - 5 - methyl - 2 - thiazyl) -, and di-HBr, 4178¹.
1,4 - Piperazinedicarboxamide, *N*, *N'* - diallyldithio-, 4178¹.
 $C_{12}H_{20}O$ Ketone, 2 - camphanyl methyl, 2433¹.
 Δ^3 α - 3 - *p* - Menthanecetaldehyde, 2155⁹.
Menthol, 3-ethinyl-, 2155⁹.
Tricyclo[2.2.1.0.2,4]heptane, 1⁹ (ethoxy-methyl) - 7,7 - dimethyl -, 4686⁷.
 $C_{12}H_{20}O_2$ Borneol, acetate, 129⁹, 1553⁹, P 4951⁹.
Camphanecarboxylic acid, Me ester, 2433¹.
Geraniol, acetate, 1467⁹.
Isoborneol, acetate, 3693¹, P 4951⁹.
Linalool, acetate, 1467⁹.
 $C_{12}H_{20}O_3$ Cyclohexaneacetic acid, 1-acetonyl -, Me ester, 3672⁹.
 $C_{12}H_{20}O_4$ 1,2 - Cyclohexanedicarboxylic acid, di-Et ester, P 154³, P 2986⁹.
Cyclohexanediol, dipropionate, 46771².
1,1 - Cyclopentanediadic acid, α - methyl -, mono-Et ester, *Ag salt*, 110¹.
Spiro[cyclohexane - 1,5' - *m* - dioxane] - 2' - carboxylic acid, 2',4 - dimethyl -, 4672⁷.
 $C_{12}H_{20}O_5$ Glutaric acid, β, γ - epox - α, α, β - trimethyl-, di-Et ester, 111¹.
Phoronic acid, mono-Me ester, 1623⁷.
 $C_{12}H_{20}O_6$ Fructose, diacetone-, 4451³.

- Glucose, diacetone-, 2498^a, 4450^a.
 1,1,2 - Propanetricarboxylic acid, tri-Et ester, 1114^t.
 C₁₂H₂₀O₁₀ Dextrinose, 4676^a.
 Dextrinose, anhydride, 4676^a.
 C₁₂H₂₀O₁₀ Fructuronic acid, *d*-glucosido-, and *Ba* salt, 3440^a.
 Maltobionic acid, α -keto-, and *Ba* salt, 3440^a.
 C₁₂H₂₀Si Silicane, triethylphenyl-, 3661^t.
 C₁₂H₂₁BrN₃O₂ Valine, *N* - [*N* - (α - bromoisovaleryl)glycyl]-, 4232^a.
 C₁₂H₂₁BrO₄ Glutaric acid, α -bromo- β -isopropyl-, di-Et ester, 3668^a.
 C₁₂H₂₁BrO₁₀ Gentibiose 6'-bromohydrin, 105^a.
 C₁₂H₂₁ClN₃O₄ Leucine, *N* - (*N* - β - chlorobutyryl)glycyl]-, 2726^t.
 Norvaline, *N* - [α - (α - chloroacetamido)-valeryl]-, 2993^a.
 C₁₂H₂₁CoN₃O₂ *tert* - Ethoxoniumhexacyanocobaltate, 4198^a.
 C₁₂H₂₁N₃ 1,2 - Diethyl - 4,5,6,7 - tetrahydro-methylindazolium iodide, 2972^a.
 Ethyl - 4,5,6,7 - tetrahydrotrimethylindazolium iodide, 2972^a.
 Isopyrazole, 4,4 - diethyl - 3,5 - dimethyl -, allyl iodide deriv., 4700^a.
 C₁₂H₂₁NO Ketone, 2 - camphanyl methyl, oxime, 2433^t.
 $\Delta^3\alpha$ - 3 - β - Menthaneacetaldehyde, oxime, 2156^t.
 C₁₂H₂₁N₃O₃ Acetic acid, thiocyanato-, nonyl ester, 4930^a.
 C₁₂H₂₁N₃O₂ Nipecotie acid, 1-butyl-4-keto-, Et ester, -HCl, P 3477^a.
 Nipecotie acid, 1 - isobutyl - 4 - keto -, Et ester, -HCl, P 3477^a.
 C₁₂H₂₁N₃O₂ Cellulosamine, 3572^a.
 C₁₂H₂₁N₃O₂ Cyclohexanone, 4 - cyclopentyl -, semicarbazone, 4680^t.
 C₁₂H₂₁N₃O₂ Camphor, 3 - methoxy -, semicarbazone, 3693^a.
 C₁₂H₂₁N₃O₂ Cyclohexaneacetic acid, 1-acetonyl-, semicarbazone, 3672^a.
 Cyclopentaneacetic acid, 1 - acetonyl -, Me ester, semicarbazone, 3673^a.
 C₁₂H₂₁N₃O₂ Glycine, *N* - [*N* - [*N* - (β aminobutyl)glycyl] glycyl] glycyl]-, 1389^a.
 C₁₂H₂₁N₃Et₃ + 7H₂O, 2674^t.
 C₁₂H₂₁AsCl Arsine, chlorocyclohexyl-, 120^a.
 C₁₂H₂₁BrN₃O₂ Leucine, *N* - (α - bromocaproyl)-, 3210^a.
 Norleucine, *N* - (α - bromocaproyl) -, 3210^a.
 —, *N* - (α - bromoisocaproyl) -, 3210^a.
 C₁₂H₂₁BrO₂ Lauryl bromide, α -bromo-, 4463^a.
 C₁₂H₂₁FeN₃O₂ Addn. compd. of H₂Fe(CN)₄ and C₂H₅OH, 3638^a.
 C₁₂H₂₁HgO₂ 2-Octene, Hg(OAc)₂ compd., 3890^a.
 C₁₂H₂₁N₃ 1,3 - Cyclohexanediamine, *N* - cyclohexenyl-, 1131^a.
 C₁₂H₂₁N₃O₂ Citronellol, allophanate, 4187^a.
 C₁₂H₂₁N₃O₂ Leucine, *N* - (*N* - butyryl)glycyl -, 1389^a.
 1 ϵ - Piperazinepropionic acid, 4 - carboxy -, di-Et ester, 2183^a.
 C₁₂H₂₁N₃O₂ Leucine, *N* - [*N* - (*N* - glycyglycyl)glycyl]-, 4232^a.
 C₁₂H₂₁N₃O₂ Cyclopentanealdehyde, 4 - acetyl - 2,2 - dimethyl -, semicarbazone, 3694^t.
 Disemicarbazone, m. 210-2^a, of compd. from nopinane and O₂, 2167^t.
 C₁₂H₂₁O₂ Δ^3 - Cyclohexanol, 2,5 - diisopropyl -, 4464^a.
 Ether, decahydronaphthyl ether, 3674^a.
 3 - β - Menthaneacetaldehyde, 2156^a.
 C₁₂H₂₁O₂ Cyclohexaneacetic acid, P 848^a.
 Cyclopentanebutyric acid, α -propyl-, P 3543^a.
 Undecanaphtheneic acid, Me ester, 4935^a.
 C₁₂H₂₁O₂ Capric anhydride, 4440^a.
 Cyclohexaneacetic acid, 1-ethoxy-, Et ester, 4454^a.
 Rhodinol, ester with Me acid carbonate, 124^a.
 C₁₂H₂₁O₄ 1,10 - Decanedicarboxylic acid, 496^a.
 1,3 - Dioxolane, 2,2' - (2,3 - dimethyl -1,4 - butylene)bis-, 2937^a.
 C₁₂H₂₁O₂ Glucoside, 2,3 - dimethyl - 5,6 - acetone-methyl -, 102^a.
 Tartaric acid, di-Bu and diisobutyl esters, 4448^a.
 C₁₂H₂₁O₁₀ Cellodexose, 3670^a.
 C₁₂H₂₁O₂S₂ Disulfide, diglucosyl, 4932^a.
 C₁₂H₂₁O₁₁ (See also *Cellulobiose*; *Lactose*; *Maltose*; *Melibiose*; *Sucrose*; *Sucrose B*; *Sucrose C*; *Sucrose D*; *Turanose*.)
 Dextrinose, 4676^a.
 Disaccharide, m. 85^a, from β -tetracetylglucose, 377^a.
 Galactose, galactosido-, 106^a, 107^a.
 —, glucosido-, 106^a.
 —, 6-mannosido-, 107^a.
 Isosucrose, 2426^a.
 Mannose, mannosido-, 107^a.
 Trehalose, 1116^t, 5089^a.
 C₁₂H₂₁O₁₂ Lactobionic acid, 3902^t, P 4230^t, and *Ca* salt, P 2988^a.
 C₁₂H₂₁BrN₃O₂ Isocaproamide, α - (α - bromoisocaproyl)amino-, 4232^a.
 C₁₂H₂₁N₃O₂ Lauric acid, λ -bromo-, 3684^t.
 C₁₂H₂₁N₃ Isopyrazole, 4,4 - diethyl - 3,5 - dimethyl-, isopropyl iodide deriv., 4700^a.
 PrI deriv., 4700^a.
 C₁₂H₂₁N₃ Pyrrolidine, 1 - cyclohexyl - 2,5 - dimethyl-, 4462^t.
 C₁₂H₂₁NO Campholamide, *N*-ethyl-, 3208^t.
 3 - β - Menthaneacetaldehyde, oxime, 2156^a.
 C₁₂H₂₁NO₁₂, 4714^t.
 Diglucosylamine, 1624^a.
 C₁₂H₂₁N₃O₂ Cyclohexanone, isoamoxy-, semicarbazone, 1131^a.
 2 - Propanone, 1 - (1 - ethoxycyclohexyl) -, semicarbazone, 4454^a.
 C₁₂H₂₁N₃O₂ Norvaline, *N* - (α - glycyaminovaleryl)-, 2993^a.
 Valine, *N* - (*N* - glycyvalyl)-, 2993^a.
 —, *N* - (*N* - valylglycyl)-, 4232^a.
 C₁₂H₂₁O₁₁P See *Trehalosephosphoric acid*.
 C₁₂H₂₁ 1-Decene, 2-ethyl-, 2934^a.
 1-Dodecene, 3897^a.
 C₁₂H₂₁Ag₂MoN₃O₄ + 2H₂O, 1587^t.
 C₁₂H₂₁Ag₂N₃O₄Se + 12H₂O, 1587^t.
 C₁₂H₂₁Ag₂N₃O₄W + H₂O, 1587^t.
 C₁₂H₂₁AuCl₂KB₂ + 4H₂O, 1586^t.
 C₁₂H₂₁BiO₂N₃ Compd. of BiCo(CN)₅ with (H₂N)₂CS, 5368^a.
 C₁₂H₂₁BrSe Selenophene, 1,1'(1,1') - (1,4 - butylene)bis[1 - bromo - 2,3,4,5 - tetrahydro-, 8704^a.
 C₁₂H₂₁CaCl₂N₃ + 10H₂O, 2896^a.
 C₁₂H₂₁Cl₂FeN₃ + 9H₂O, 2896^a.
 C₁₂H₂₁Cl₂MgN₃ + 10H₂O, 2896^a.
 C₁₂H₂₁Cl₂MnN₃ + 10H₂O, 2896^a.
 C₁₂H₂₁Cl₂N₃O₂Pt₂, 1581^t.
 C₁₂H₂₁Cl₂N₃Se, 2896^a.
 C₁₂H₂₁Cl₂N₃Sr + 9H₂O, 2896^a.

- $C_{12}H_{21}Cl_2N_2Zn$, 2896⁷.
 $C_{12}H_{24}Cl_4N_2O_4Pt$, 1581⁹, 1582⁹.
 $C_{12}H_{24}Cl_4N_2Zn_2 + 6H_2O$, 2896⁷.
 $C_{12}H_{21}N_3O$ Cyclohexanone, oxime, diethylaminoethyl deriv., P 43011.
 $C_{12}H_{21}N_3O_2$ Succinamide, *N, N, N', N'* - tetraethyl-, 4190⁸.
 $C_{12}H_{21}N_3O_2$ Glycine, *N*-leucyl-, Bu and isobutyl esters, -HCl, 603⁷.
 Leucine, *N*-norleucyl-, 3210⁸.
 Norleucine, *N*-leucyl-, 3210⁸.
 —, *N*-norleucyl-, 3210⁸.
 $C_{12}H_{21}N_4O_2$ 2,5 - Piperazinedione, 1,4 - dimethyl-, compd. with Et carbamate, 140⁹.
 $C_{12}H_{21}O$ Ether, cyclohexyl hexyl, 3674¹.
 Lauraldehyde, 5168⁹.
 $C_{12}H_{21}O_2$ (See also *Lauric acid*.)
 Capric acid, α -ethyl-, 2934⁹.
 Cyclohexane, 1,3-dipropoxy-, 4677³.
m - Dioxane, 2 - hexyl - 5,5 - dimethyl -, 1615⁹.
 1,3 - Dioxolane, 4,5 - diethyl - 2 - isopropyl - 4,5-dimethyl-, 1615⁹.
 3 - Octanol, 3,7 - dimethyl -, acetate, 2421³.
 $C_{12}H_{21}O_2$ Lauric acid, λ -hydroxy-, and Mg salt, 506³.
 Sabinic acid, 1388³, 3663⁹.
 Undecylic acid, α -hydroxy-, Me ester, 1388³, 3663⁹.
 $C_{12}H_{21}S_2$ Formic acid, dithio, Pr ester, trimer, 3439¹.
 $C_{12}H_{21}As$ Arsine, cyclohexyldipropyl, 121¹.
 $C_{12}H_{21}AsCl_2$ Arsine, cyclohexyldipropyl-, dichloride, 121¹.
 $C_{12}H_{21}AsO_2$ Dipinacone-arsonic acid, 596¹.
 $C_{12}H_{21}AuCl_2K_2S_2 + 2H_2O$, 1586⁷.
 $C_{12}H_{21}Br$ Decane, 1-bromo-2-ethyl-, 2934⁹.
 $C_{12}H_{21}N$ Cyclopentaneethylamine, *N, N, 2,2,3*-pentamethyl-, and -HCl, 1405⁷.
 $C_{12}H_{21}NO$ Capramide, α, α -dimethyl, 125¹.
 2 - Hexanol, 5 - cyclohexylamino -, 4462¹.
 2 - Pentanol, 4 - cyclohexylamino - 3 - methyl-, 4462¹.
 $C_{12}H_{21}NO_2$ Caproamide, *N, N, \gamma* - triethyl - γ - hydroxy-, 4190⁷.
 $C_{12}H_{21}NO_2$ Mannamine, *N* - cyclohexyl-, and -HCl, 111¹, 112¹.
 $C_{12}H_{21}N_3O$ 3-Hendecanone, semicarbazone, 2934⁹.
 Pelargonaldehyde, γ, γ - dimethyl - (?), semicarbazone, 3702⁹.
 $C_{12}H_{21}N_3O_2$ Isocaproamide, α - leucylamino -, -HBr, 4232⁴.
 $C_{12}H_{21}$ Decane, 2,6-dimethyl-, 2421³.
 $C_{12}H_{21}AsBrO$ Arsine, cyclohexyldipropyl-, hydroxybromide, 121¹.
 $C_{12}H_{21}AsNO_2$ Carbamic acid, (γ - arsonopropyl) hexyl-, Et ester, 92⁹.
 $C_{12}H_{21}Au_2Cl_4S_2 + 2H_2O$, 1586⁷.
 $C_{12}H_{21}ClNO_2$ 2,3,6 - Trimethylglucosidotrithylammonium chloride, 1116⁹.
 $C_{12}H_{21}Cl_4N_2O_4Pt$, 1582⁹.
 $C_{12}H_{21}Hg_2O_2S$ Hexane, 1 - (hydroxymercuri) -, sulfate, 1871³.
 $C_{12}H_{21}IN$ Trimethyl - 2 - propylcyclohexyl ammonium iodide, 144⁴.
 $C_{12}H_{21}INO_2$ (β - Carboxyethyl)methylpropyl ammonium iodide, Et ester, 1390³.
 $C_{12}H_{21}O$ 1-Decanol, 2,2-dimethyl-, 125¹.
 1-Decanol, 2-ethyl-, 2934⁹.
 Dodecyl alcohol, 5074⁹.
 $C_{12}H_{21}O_2$ 1,12-Dodecanediol, 817⁹, 4439⁹.
 $C_{12}H_{21}S_2$ Decyldimethylsulfonium iodide, 4670¹.
 $C_{12}H_{21}N$ Isononylamine, *N, N, \gamma* - trimethyl -, 2934⁹.
 $C_{12}H_{21}NO_2$ Propionaldehyde, β, β' - ethyliminobis-, bis(dimethyl acetal), 3209³.
 $C_{12}H_{21}NO_2$ 2,3,6 - Trimethylglucosidotrithylammonium hydroxide, 1116⁹.
 $C_{12}H_{21}OP$ Phosphine oxide, tributyl-, 2150⁹.
 $C_{12}H_{21}O_2P$ Butyl phosphate, P 3477⁸.
 $C_{12}H_{21}P$ Phosphine, tributyl-, and $HgCl_2$ addn. compd., 2150⁹.
 Phosphine, trisobutyl-, and $HgCl_2$ compd., 4442¹.
 $C_{12}H_{21}As_2$ Biarsine, tetrapropyl-, 120³.
 $C_{12}H_{21}Au_2Cl_4N_2$ 1,1,4,4 - Tetraethylpiperazinium dichloraurate, 92³.
 $C_{12}H_{21}BrP$ Tetrapropylphosphonium bromide, 4441⁹.
 $C_{12}H_{21}IN$ Tetrapropylammonium iodide, 3390⁹.
 $C_{12}H_{21}N_2$ 1,1,4,4 - Tetraethylpiperazinium diiodide, 92³.
 $C_{12}H_{21}N_2$ (See also *Synthalin*.)
 Guanidine, decamethylenebis-, P 1547, sulfate, P 1639⁹.
 $C_{12}H_{21}OS$ Decyldimethylsulfonium hydroxide, 1670¹.
 $C_{12}H_{21}NO$ Trimethylnonylammonium hydroxide, 2419⁸.
 $C_{12}H_{21}Cl_4N_2O_4Pt$, 5428¹.
 $C_{12}H_{21}Cl_4N_2Sn$ Diethyltrimethylammonium chlorostannate, 5077³.
 $C_{12}H_{21}CrO_4$ Chromium ethoxide compd with EtOH, 4904⁴.
 $C_{12}H_{21}Cl_4N_2O_4Pt$, 5428¹.
 $C_{12}H_{21}Br_2CdN_2 + 3H_2O$, 3868¹.
 $C_{12}H_{21}CdCl_4N_2$, 3868¹.
 $C_{12}H_{21}Mn_2N_2O_{12} + 6H_2O$, 4904⁴.
 $C_{12}H_{21}K_2Ni_2O_{12} + H_2O$, 4904⁴.
 $C_{12}H_{21}Ni_2O_{12} + 4H_2O$, 4901⁹.
 $C_{12}H_{21}Ni_2Rh_2$, 2674³.
 $C_{12}H_{21}Br_2N_2O_4$ Xanthone, 2,7 - dibromo - 4,6 - dinitro-, 2182³.
 $C_{12}H_{21}N_2O_6$ Xanthone, 2,4,5,7 - tetranitro -, 2182⁴.
 $C_{12}H_7Br_2N_2S$ Benzothiazole, 5-bromo - 1 - *p* - bromoanilino-, dibromo deriv., 2973⁹.
 $C_{12}H_7Cl_4N_2O_4$ Phenol, dichloronitro-, *m* nitrobenzoate, 2957⁴.
 $C_{12}H_7N_2O_4$ Xanthone, dinitro-, 2182^{3,4}.
 $C_{12}H_7N_2O_4$ Benzophenone, 2,2',4',4'-tetra-bromo -, 1903³.
 $C_{12}H_7O_2$ Hexane - 1,4,5,6 - tetrol < 1,5 > anhydride, benzaldehyde deriv., 3671⁹.
 $C_{12}H_7O_2S$ 1,4,9 - Thioxanthetrione S-dioxide, 1901¹.
 $C_{12}H_7Br_2N_2O_4$ Aniline, 3,5 - dibromo - *N* - (2,4-dinitrobenzal), 4682⁹.
 $C_{12}H_7ClO_2S$ Thioxanthone, 2(or 3) - chloro 1,4 - dihydroxy -, S-dioxide, 1901¹.
 $C_{12}H_7Cl_2NO_4$ Phenol, 2,4 - dichloro -, *m*-nitrobenzoate, 2957⁴.
 $C_{12}H_7Cl_3N_2O_4$ Benzaldehyde, 3,4,5 - trichloro - 2 - nitro -, *p* - nitrophenylhydrazone, 1891⁴.
 $C_{12}H_7NO_4$ 6,7 - Benzoquinoline - 5,10 - dione, 6,9-dihydroxy-, 3471⁵, 3928⁹, 3929¹.
 $C_{12}H_7BrClO$ Benzophenone, 4 - bromo - 4' - chloro-, 2962³, 3922³.
 $C_{12}H_7BrFN_2O_3$ Salicylaldehyde, bromofluoronitro -, *p* - nitrophenylhydrazone, 5177³.
 $C_{12}H_7BrN_2O_4$ Benzaldehyde, 2 - bromo - 4 - hydroxy - 3,5 - dinitro -, *p* - nitrophenylhydrazone, 1893⁹.
 Salicylaldehyde, 4 - bromo - 3,5 - dinitro -, *p*-nitrophenylhydrazone, 1893⁹.

- Benzaldehyde, 2 - fluoro - 4 - hydroxy - 5 - nitro -, phenylhydrazone, 5177¹.
 Salicylaldehyde, 4 - fluoro -, *p* - nitro-phenylhydrazone, 5176¹.
 —, 4-fluoro-2-nitro-, phenylhydrazone, 5177¹.
 C₁₂H₁₀FeN₂O₃ Pyridine, compd. with Fe(CO)₅, 837¹.
 C₁₂H₁₀IN₂O₂ Benzaldehyde, 4 - hydroxy - 2 - iodo - 5 - nitro -, phenylhydrazone, 1894¹.
 Salicylaldehyde, 4 - iodo - 5 - nitro -, phenylhydrazone, 1894¹.
 C₁₂H₁₀N₂ Acridine, amino-, P 3932¹.
 Benzonitrile, *p* - (*p* - aminophenyl) -, 2961¹.
 C₁₂H₁₀N₂O₈ Phenol, 4 - amino - 2 - (1 - benzothiazolyl) -, 5184¹.
 C₁₂H₁₀N₂O₈ Benzisotulfonazole, 2 - anilino -, 4680¹.
 C₁₂H₁₀N₂O₈ Benzoic acid, *o* - (*p* - hydroxyphenyl-azo) -, 4679¹.
 Benzophenone, *p* - nitro-, oxime, 3681¹.
 C₁₂H₁₀N₂O₈ 1,2 - Pyran - 4 - carboxylic acid, 3,6 - dihydro - 2,3,6 - triketone -, Me ester, 3 - phenylhydrazone, 1879¹.
 C₁₂H₁₀N₂O₈ 3 - Hydantoinacetic acid, 5 - piperonylidene -, 2 thio -, 820¹.
 C₁₂H₁₀N₂O₈ 3 - Hydantoinacetic acid, 5 - piperonylidene -, 820¹.
 C₁₂H₁₀N₂O₈ Benzenesulfonic acid, *p* - nitro -, nitro - *p* - tolyl ester, 830¹.
 C₁₂H₁₀N₂O₈ Methionine acid, cyanonaphthyl-carbamyl -, 3205¹.
 C₁₂H₁₀N₂O₈ Methionine acid, bis(*p* - nitro-phenyl) ester, 98¹.
 C₁₂H₁₀N₂O₈ Dibenzene - 1,3 - diazepin - 6(7) - one, thio-, 3457¹.
 C₁₂H₁₀N₂O₈ 1,2,3,4 - Tetrazole, 1,5 - diphenyl -, P 396¹, P 1909¹.
 C₁₂H₁₀N₂O₈ Hydrazomethylene, 1 - phenylazo - 2 - phenyl - 1,3 - endoxy -, 4939¹.
 Tetrazole, 1,4 - diphenyl - 3,5 - endoxy -, 4939¹.
 C₁₂H₁₀N₂O₈ Azobenzene, methylidinitro -, 118¹, 823¹.
 C₁₂H₁₀N₂O₈ Anisole, *p* - (2,4 - dinitrophenyl-azo) -, 4679¹.
 Anisole, 2 - nitro - 4 - (*p* - nitrophenylazo) -, 824¹.
 C₁₂H₁₀N₂O₈ Protocatechualdehyde, 6 - nitro -, *p* - nitrophenylhydrazone, 4204¹.
 C₁₂H₁₀N₂O₈ *p* - Benzenesulfonotoluene, 2',4,6' - trinitro-, 830¹.
 C₁₂H₁₀N₂O₈ (See also *Benzophenone*.)
 2-Fluorenone, 4691¹.
 Xanthene, 4468¹.
 C₁₂H₁₀N₂O₈ 9-Thioxanthene, 4468¹.
 C₁₂H₁₀N₂O₈ 3 - Acenaphthenecarboxylic acid, P 4951¹.
 Benzoic acid, Ph ester, 3935¹.
 —, *p* - phenyl-, 2962¹.
 Xanthidrol, 4468¹.
 C₁₂H₁₀N₂O₈ (See also *Salol*.)
 Carbonic acid, di-Ph ester, 1056¹.
 C₁₂H₁₀N₂O₈ Benzoic acid, *o* - (*p* - hydroxyphenyl-mercapto) -, 828¹.
 C₁₂H₁₀N₂O₈ 1-Naphthoic acid, 7-hydroxy-, acetate, 2435¹.
 C₁₂H₁₀N₂O₈ Benzoic acid, *o* - (2,4 - dihydroxy-phenylmercapto) -, 828¹, 1901¹.
 C₁₂H₁₀N₂O₈ Umbelliferone, 3,6 - diacetyl -, 829¹.
 C₁₂H₁₀N₂O₈ Benzoic acid, *o* - (2,4 - dihydroxy-phenylmethyl) -, 1901¹.
 Thiochromone, 2,3 - dihydroxy -, disaccharate, 2441¹.
 C₁₂H₁₀N₂O₈ Benzoic acid, *o* - (2,5 - dihydroxy-phenylsulfonyl) -, 1901¹.
 C₁₂H₁₀N₂O₈ Benzenesulfonic acid, *o* - (2,4,5 - trihydroxybenzoyl) -, and salts, 2964¹.
 C₁₂H₁₀N₂O₈ Benzophenone, thio-, 180¹, 879¹.
 Thioxanthene, 4468¹.
 C₁₂H₁₀N₂BrN Phenarsazine, 1 - bromo - 1,6 - dihydromethyl-, 3447¹, 4474¹.
 C₁₂H₁₀N₂BrN₂O₂ Arsine, dibromo[*o* - {5(and 6) - nitro - *o* - toluino]phenyl] -, 4474¹.
 C₁₂H₁₀N₂ClN Phenarsazine, 1 - chloro - 1,6 - dihydromethyl-, 3447¹, 4474¹, 4704¹.
 C₁₂H₁₀N₂Cl₂N₂O₂ Arsine, dichloro[2 - (*o* - nitro-anilino) - *p* - tolyl] -, 4473¹.
 Arsine, dichloro[nitro(toluino)phenyl] -, 4474¹.
 C₁₂H₁₀N₂IN Phenarsazine, 1,6 - dihydro - 1 - iodo - 2(or 4) - methyl -, 4474¹.
 C₁₂H₁₀N₂IN₂O₂ Phenarsazinic acid, methylnitro -, and salts, 4473¹, 4474¹, 4475¹.
 C₁₂H₁₀N₂O₈ Anthranilic acid, *N* - (4 - arsono - 2-nitrophenyl) -, 2954¹.
 C₁₂H₁₀Br Biphenyl, *o* - (bromomethyl) -, 2710¹.
 C₁₂H₁₀BrN Azobenzene, bromomethyl -, 823¹, 4400¹.
 C₁₂H₁₀BrN₂O Anisole, 2-bromo-4-phenylazo -, 824¹.
 Azoxybenzene, *p* - bromo - *p*' - methyl -, 4400¹.
 C₁₂H₁₀BrN₂S Carbanilide, bromothio-, 3445¹.
 C₁₂H₁₀BrO₂ 2 - Naphthaleneacetic acid, 6 bromo - 1 - methyl -, 3699¹.
 Resorcinol, 4 - benzyl - 6 - bromo -, 1407¹.
 —, 4-(*p*-bromobenzyl) -, 1407¹.
 C₁₂H₁₀BrN₂O Aniline, 3,5 - dibromo - 4 - (*p* - methoxyphenoxy) -, 5172¹.
 C₁₂H₁₀Cl Biphenyl, *o* - (chloromethyl) -, 2710¹.
 C₁₂H₁₀ClN₂O Benzanilide, aminochloro -, 3900¹.
 C₁₂H₁₀ClN₂S Carbanilide, chlorothio-, 3445¹.
 C₁₂H₁₀ClN₂O Hydrazine, *β* - (5 - chloro - 2,4 - dinitrophenyl) - *α* - methyl - *α* - phenyl -, 118¹.
 C₁₂H₁₀ClO *α,γ,ε* - Heptatrienoyl chloride, *γ* - phenyl-, 3689¹.
 C₁₂H₁₀ClO₂ Resorcinol, 4-benzyl-6-chloro-, 1407¹.
 Resorcinol, 4 - (*p* - chlorobenzyl) -, 1407¹.
 C₁₂H₁₀Cl₂N₂O Aniline, 3,5 - dichloro - 4 - (*p* - methoxyphenoxy) -, 5173¹.
 C₁₂H₁₀Cl₂N₂O₂ Phenol, 3 - amino - 2,4 - di-chloro -, *p* - toluenesulfonate, 2957¹.
 C₁₂H₁₀Cl₂N₂O₂ *m* - Benzenedisulfonyl chloride, 5 - nitro -, compd. with toluene, 2428¹.
 C₁₂H₁₀Cl₂N₂O₂ *m* - Benzenedisulfonyl chloride, 5-nitro-, compd. with anisole, 2428¹.
 C₁₂H₁₀Cl₂N₂ Benzaldehyde, 4 - amino - 3,5 - dichloro -, phenylhydrazone, 1891¹.
 C₁₂H₁₀Cl₂ Methane, (*o* - iodophenyl)phenyl -, 1409¹.
 C₁₂H₁₀IN₂S Carbanilide, *p* - iodothio -, 3445¹.
 C₁₂H₁₀IN₂ (See also *Acridon*.)
 Aniline, *N* - benzal-, 2951¹, 4199¹.
 Compd., m. 53°, from bromo deriv. of PhCH₂NHPh, 392¹.
 2-Fluorylamine, 1895¹, 4691¹.
 C₁₂H₁₀NO Benzophenone, oxime, 3681¹.
 2-Fluorenone, amino -, 4691¹.
 C₁₂H₁₀NO₂ Acenaphthenecarboxylic acid, amino -, P 397¹, P 1233¹.
 Iodophenol, methyl-, 3450¹.
 3 - *p* - Toluquinonimine, *N* - salicyl -, 3450¹.
 C₁₂H₁₀NO₂ *p* - Resorcinamide, thio-, 3218¹.
 C₁₂H₁₀NO₂ Iodophenol, methoxy -, 3450¹.
 1-Naphthoic acid, 3-acetamido-, 3463¹.

- $C_{12}H_{11}NO_3S$ 5 - Acridansulfonic acid, and Na salt, 144^a.
- $C_{12}H_{11}NO_3S$ 2 - Thianthrenesulfonic acid, 3 - amino - 6 - methyl -, and Ba salt, 3468^a.
- $C_{12}H_{11}NO_4$ 1-Naphthoic acid, nitro-, Et ester, 3463^a.
- $C_{12}H_{11}NO_3S$ 2 - Furanmethylmercaptan, methyl-, *p*-nitrobenzoate, P 155¹.
- Phenylsulfuric acid, *p* - benzalamino -, K salt, 2160^a.
- $C_{12}H_{11}NO_3S$ Benzenesulfonic acid, 5 - nitro - 2 - *p* - tolylmercapto-, 3468^a.
- $C_{12}H_{11}NO_3S$ Benzenesulfonic acid, *p* - nitro-, *p*-tolyl ester, 830^a.
- Cinchoninic acid, 3 - (carboxymethyl mercapto) - 1,2 - dihydro - 2 - keto - 1 - methyl-, 2443^a.
- $C_{12}H_{11}NS$ 2 - Thianthrenamine, 7 - methyl -, 3468^a.
- $C_{12}H_{11}N_2$ Acridine, diamino-, P 3932^a.
- 2,3,7,8 - Dibenzo - 1,4,5 - octatriazine, and -HCl, 380^a.
- 9 - Fluorenone, 2 - amino -, hydrazone, 5180^a.
- $C_{12}H_{11}N_2O$ 5(10) - Acridone, 2,8 - diamino -, 1904^a.
- 2,1,3 - Benzotriazole, 2 - *p* - anisyl -, 836^a.
- 1,2,4 - Benzotriaz - 3(2) - one, 1,4 - dihydro - 4 - phenyl -, 379^a.
- $C_{12}H_{11}N_2O$ Azobenzene, methylnitro -, 823^a.
- Benzaldehyde, *p*-nitro-, phenylhydrazone, 3470^a.
- Formamide, (*p* - phenoxyphenylazo)-, 4679^a.
- 2 - Naphthalenepropionitrile, *p* - imino - 1,4-diketo -, NH_2 deriv., 387^a.
- $C_{12}H_{11}N_2O$ Benzaldehyde, *p* - hydroxy -, *p* - nitrophenylhydrazone, 2429^a.
- Cresol, (nitrophenylazo)-, 3158^a.
- $C_{12}H_{11}N_2O$ Protocatechualdehyde, 6 - nitro -, phenylhydrazone, 4204^a.
- $C_{12}H_{11}N_2O$ Pyrone, dimethyl-, picrate, 5088^a.
- $C_{12}H_{11}N_3S$ 1,2,4 - Benzotriazine - 3 - mercaptan, 1,4 - dihydro - 1 - phenyl -, 1398^a.
- $C_{12}H_{11}N_2O$ Quinone, 2,4 - dinitrophenylhydrazone, semicarbazone, 4679^a.
- $C_{12}H_{11}$ Methane, diphenyl, 318^a, 1348^a, 1895^a, 3215^a, 3628^a.
- $C_{12}H_{11}AsCl_4$ Phenarsazine, 7 - amino - 1 - chloro - 1,6 - dihydro - 4 - methyl -, -HCl, 4473^a.
- $C_{12}H_{11}AsNO_3$ Phenazarsinic acid, methyl-, and -HCl, 2447^a.
- $C_{12}H_{11}Br_2Sn$ Stannane, benzyldibromophenyl-, 5470^a.
- $C_{12}H_{11}Cl_2NO_3S$ Benzenesulfonanilide, 2 - chloro - 6-(hydroxymethyl)-, 2163^a.
- $C_{12}H_{11}Cl_2NO$ Benzanilide, 2' - chloro - 4 - hydrazino-, -HCl, 3900^a.
- $C_{12}H_{11}Cl_2NO_3S$ Phenol, 5 - amino - 2,4 - dichloro -, 8 - amino - *p* - toluenesulfonate, 2957^a.
- $C_{12}H_{11}Cl_2Sn$ Stannane, benzyldichlorophenyl -, 118^a.
- $C_{12}H_{11}MoW_2O_{14}$, 2899^a.
- $C_{12}H_{11}N_2$ Azobenzene, *p*-methyl-, 4406^a.
- $C_{12}H_{11}NO$ (See also Carbanilide.)
- Azoxybenzene, *p*-methyl-, 4406^a.
- Benzylamine, *N* - nitroso - *N* - phenyl -, 3445^a.
- Cresol, phenylazo-, 2429^a, 3158^a.
- Indoaniline, 3'-methyl-, 3451^a.
- Phenol, *p*-(tolylazo)-, 2429^a, 3158^a.
- Pyridine, 2 - *N* - methylbenzamido -, 837^a.
- $C_{12}H_{11}N_2OS$ Carbanilide, *p* - hydroxythio -, 3445^a.
- $C_{12}H_{11}N_2O$ Benzylamine, *N* - (*p* - nitrophenyl)-, 379^a.
- Saligenin, 5-phenylazo-, 121^a.
- $C_{12}H_{11}N_2O_2S$ Carbanilide, *p*, *p'* - dihydroxythio-, P 3233^a.
- $C_{12}H_{11}N_2O_3$ Acetamide, *N* - methyl - *N* - (6 - nitro - 2 - naphthyl) -, 4466^a.
- Barbituric acid, allylphenyl-, P 1217^a.
- $C_{12}H_{11}N_2O_3S$ *p* - Benzenesulfonotoluide, *p* - nitro -, 830^a.
- 3 - Hydantoinacetic acid, 5 - anisal - 2 - thio-, 820^a.
- $C_{12}H_{11}N_2O_3$ 1 - Hydantoinacetic acid, 5 - anisal -, 3443^a.
- $C_{12}H_{11}NS$ Carbanilide, thio-, P 156^a, 3214^a.
- $C_{12}H_{11}N$ Guanidine, (*p* - aminophenyl) - *p* - phenylene -, and -HCl, 2158^a.
- $C_{12}H_{11}N_2O$ 3,4 - Benzo - 1,2,5,6 - heptatetrazine, 1 - *N* - phenyl - 7 - hydroxy -, 380^a.
- 3,4 - Benzo - 1,2,5,6 - oxheptatriazine, 7-phenylamino-, 380^a.
- Semicarbazide, phenylphenylimino -, 576^a, 4635^a.
- Urea, (*p* - phenylazophenyl)-, 3442^a.
- $C_{12}H_{11}N_2O_2$ Semicarbazide, 1 - (*o* - nitrophenyl) - 4 phenyl-, 379^a.
- $C_{12}H_{11}N_2O_3S$ Benzenesulfonamide, *p*-formyl-, *p* nitrophenylhydrazone, 4680^a.
- Benzenesulfonazole, 1,2 - dihydro - 2 - (β - *p* nitrophenylhydrazino)-, 4680^a.
- $C_{12}H_{11}N_2O$ Benzylamine, picrate, 4461^a.
- $C_{12}H_{11}N_2O$ Carbohydrazide, α , δ - bis(*o* - nitrophenyl)-, 380^a.
- $C_{12}H_{11}O$ (See also Benzohydroxol.)
- Benzyl alcohol, *o* - phenyl -, 2710^a.
- Ether, benzyl phenyl, 2955^a.
- α , γ , ϵ - Heptatrienaldehyde, *f*-phenyl-, 3687^a.
- Phenol, *p*-benzyl-, 2955^a.
- $C_{12}H_{11}OS$ Anisole, *m*-phenylmercapto-, 2956^a.
- Phenol, *p* - (*p* - tolylmercapto) -, 2956^a.
- $C_{12}H_{11}O$ α , γ , ϵ - Heptatrienic acid, *f* - phenyl -, and salts, 3688^a.
- 2 - Naphthaleneacetic acid, 1 - methyl -, 3699^a.
- 1-Naphthoic acid, Et ester, P 154^a, 5182^a.
- $C_{12}H_{11}O$ Benzohydroxol, dihydroxy -, 384^a, 4468^a.
- 6 - Dibenzopyrone, 7,8,9,10 - tetrahydro - 3-hydroxy-, 383^a.
- 1-Naphthoic acid, 4-ethoxy-, P 2190^a.
- Umbelliferone, 3 - allyl - 4 - methyl -, 2959^a.
- $C_{12}H_{11}O_2S$ 2 - Naphthol, 3,6 - dimercapto -, Et carbonate, 1129^a.
- $C_{12}H_{11}O_2S$ 2 - Naphthol, 3,6,8 - trimercapto -, Et carbonate, 1129^a.
- $C_{12}H_{11}O$ Coumarin, acetyethyl - 5 - hydroxy -, 3219^a.
- Coumarin, 3 - allyldihydroxy - 4 - methyl -, 2959^a.
- Δ^5 2,4 - Hexenedione, 6 - (3,4 - methylene dioxyphenyl)-, 4211^a.
- Malonic anhydride, (α - acetonilbenzyl) -, 3210^a.
- $C_{12}H_{11}O_2$ Malonic acid, *p*-methoxycinnamal-, 3912^a.
- $C_{12}H_{11}O_2$ 2,1 - Benzopyran - 3 - carboxylic acid, 1 - keto - 5,6,7 - trimethoxy -, and Ag salt, 3699^a.
- $C_{12}H_{11}O_2$ Cinnamic acid, 2,5 - dihydroxy -, bis(methylocarbonate), 4211^a.
- $C_{12}H_{11}O_3S_3$ 2 - Naphthol - 3,6,8 - trisulfonic acid, Et carbonate, tri-K salt, 1129^a.

- C₁₈H₁₂S** Benzyl mercaptan, *o*-phenyl-, 2710⁴.
C₁₈H₁₁AsN₂O₂ Phenazarsinic acid, 7-amino-4-methyl-, 4473⁴.
C₁₈H₁₁AsN₂O₄ *o* - Arsanilic acid, methyl - *N* - (nitrophenyl)-, and salts, 4473^{4,5,6}.
o - Arsanilic acid, *N* - (nitrotolyl)-, and salts, 4473^{7,8,9}, 4474^{1,2,3}.
C₁₈H₁₁ClO₂ Umbelliferone, 3-(chloropropyl)-4-methyl-, 2959⁷.
C₁₈H₁₁IO₂ 1,4-Pyrone, 2-methyl-6 phenyl-, methiodide, 143¹.
C₁₈H₁₁N Benzylamine, *o*-phenyl-, and -HCl, 2710³.
 Diphenylamine, *N*-methyl-, 1896².
C₁₈H₁₁NO 2-Naphthaleneacetamide, 1-methyl-, 3699¹.
C₁₈H₁₁NO₂ Acetamide, *N*-(3-methoxy-2-naphthyl)-, 833⁴.
 Benzohydrol, *p*-amino-*p'*-hydroxy-, 384¹.
o-Cresol, 4-(*p*-hydroxyanilino)-, 3450⁴.
 Isoquinoline, 6,7-methylenedioxy-1-propyl-, 2444².
 Naphthamide, ethoxy-, P 2158¹, P 2190¹.
 2-Naphthoic acid, 3-amino-, Et ester, P 154⁴.
 8-Pyrrolopyridine, 1,3-diacetyl-2-methyl-, 4218¹.
C₁₈H₁₁NO₄ Benzazete, 1-acetyl-1,2-dihydro-5-hydroxy-2-keto-4,6-dimethoxy-, acetate, 1405².
 3-Isoquinolinecarboxylic acid, 1-hydroxy-5,6,7-trimethoxy-, 3699⁹.
C₁₈H₁₁N₂ Benzaldehyde, methyl-2-pyridylhydrazone, 837⁷.
 Guanidine, diphenyl-, 901⁴, P 1417², 2495³, P 5197¹.
C₁₈H₁₁N₂O Benzanilide, hydrazino-, -HCl, 3909⁶.
C₁₈H₁₁N₂O₂ Semicarbazide, 1-(*p*-phenoxyphenyl)-, 4679⁹.
C₁₈H₁₁N₂O₃ Benzisulfonazole, 1,2-dihydro-2-β-phenylhydrazino-, 4680⁴.
C₁₈H₁₁N₂O₁₀ Hydrotubaic acid, Me ether, trinitro deriv., 382⁷.
C₁₈H₁₁N₂NaO 2-Pyrazinol, 3,6-dimethyl 5-tolylazo-, Na deHv., 3472⁵.
C₁₈H₁₁N₂O 2,3,9,10 - Dibenzo - 1,4,5,7,8 - deca-pentazine, 6-keto-, and -HCl, 380⁴.
C₁₈H₁₁ Naphthalene, isopropyl-, P 1421³.
 Naphthalene, trimethyl-, 5189¹.
C₁₈H₁₁AsNO₂ *o*-Arsanilic acid, methyl-*N*-phenyl-, 3446⁶, 3447⁶.
o-Arsanilic acid, *N*-*m*-tolyl-, 3447⁴.
C₁₈H₁₁As₂N₂O₃ See *Neosarsphenamine*.
C₁₈H₁₁As₂N₂O₃S Arsanilic acid, *N*, *N'*-thiocarbonylbis-, 3446⁴.
C₁₈H₁₁BrN Cycloheptindole, 3-bromo-5,6,7,8,9,10-hexahydro-, 138¹.
C₁₈H₁₁BrN₂O₂ 1,1-Cyclopentanediacetamide, α-bromo-α,α'-dicyano-*N*,α'-dimethyl-, 110¹.
C₁₈H₁₁Cl₂HgO 1,3-Pentadiene, 1-chloro-2-(chloromercuri)-3-ethoxy-1-phenyl-, 2695⁹.
C₁₈H₁₁N₂ 4-*m*-Tolylene-diamine, *N*²-phenyl-, 1131⁴.
C₁₈H₁₁N₂O Benzohydrol, diamino-, 384¹, 4468⁴.
 3(2) - Cyclopentapyrazolone, 1,4,5,6-tetrahydro-2-*p*-tolyl-, P 613⁹.
C₁₈H₁₁N₂O₂ Carbazole, tetrahydromethylnitro-, 139¹.
 2-Naphthoic acid, 6-(β-aminoethylamino)-, P 2733¹.
C₁₈H₁₁N₂O₂ Malonamic acid, α-benzyl-α-cyano-, Et ester, 4193⁹.
 Δ² - 3 - Pyrazolinecarboxylic acid, benzoyl-4-methyl-, Me ester, 3704⁶.
C₁₈H₁₁N₂O₃S Benzothiazole, 1-diacetylamino-5-ethoxy-, 2245².
 Thiazole, 4-(3,4-dihydroxyphenyl)-2-(*N*-methylacetamidomethyl)-, -HCl, 3470⁷.
C₁₈H₁₁N₂O Carbohydrazide, diphenyl-, 4635⁴.
 2-Pyrazinol, 3,6-dimethyl-5-tolylazo-, 3472⁴.
 Semicarbazide, 1-(*o*-aminophenyl)-4-phenyl-, and -HCl, 379⁶.
C₁₈H₁₁N₂O₄ 2-Furanpropylamine, picrate, 387⁷.
C₁₈H₁₁N₂S Carbanilide, diaminothio-, 2147⁴.
 Carbohydrazide, α,δ-diphenylthio-, 2157⁴.
C₁₈H₁₁O 1,3,5-Hexatriene, 5-methoxy-1-phenyl-(?), 2966³.
 Naphthol, isopropyl-, P 1421³.
 α,γ - Pentadienaldehyde, α,γ - dimethyl-δ-phenyl-, P 3514⁶.
 —, α-ethyl-δ-phenyl-, P 3714⁶.
C₁₈H₁₁OS₂ Naphthalene, 2-methoxy-3,6-bis-(methylmercapto)-, 1129⁶.
C₁₈H₁₁OS₃ 2-Naphthol, 3,6,8 tris(methylmercapto)-, 1129⁶.
C₁₈H₁₁O₂ Dibenzofuran, 1,2,3,4-tetrahydro-8-methoxy-, 2439⁶.
 Phenol, cyclopentenyl- acetate, 4689⁶.
C₁₈H₁₁O₃ Cinnamic alcohol, ester with allyl acid carbonate, 124⁷.
 Methysticene, dihydro-, 2965⁴.
 α,γ-Pentadienic acid, δ *p* amyl-, Me ester, 3912³.
C₁₈H₁₁O₄ Caproic acid, α benzoyl-δ keto-, 470⁶.
 Coumarin, 7,8 diethoxy-, 2719³.
 Rotenic acid, Me ester, 601³.
 Tubaic acid, Me ether, 382⁷.
C₁₈H₁₁O₅ Cresol, dimercapto-, triacetate, 825⁶.
C₁₈H₁₁O₆ Coumarin, 7,8 diethoxy-6-hydroxy-, 2719³.
 Coumarin, ethoxydimethoxy-, 2719^{3,4}.
 Samin, 2055⁴.
C₁₈H₁₁O₈ 1,3,3 Butanetricarboxylic acid, 1-phenyl-, 2710³.
 Malonic acid, phenoxyacetyl-, di Me ester, 4481¹.
C₁₈H₁₁BrO₂ 1,3-Dioxolane-4-carbinol, 2,2-dimethyl-, *p*-bromobenzoate, 2939⁷.
C₁₈H₁₁Br₂N₂ Compd. from 2-[(4,5-dimethyl-1-pyrryl)methylene]-3,5-dimethyl-*o*-pyrrole, 1134⁴.
C₁₈H₁₁Cl₂N₂O₂ Hypnal, 1411¹.
C₁₈H₁₁N Carbazole, 1,2,3,4 tetrahydro-δ-methyl-, 139¹.
 Cycloheptadole, 5,6,7,8,9,10-hexahydro-, 138¹.
C₁₈H₁₁NO 5(10)-Acridone, hexahydro-, 138¹.
 α,γ - Pentadienaldehyde, δ - (*p* - dimethylaminophenyl)-, 381⁴.
 Quinoline, 6-ethoxy-2,4 dimethoxy-, P 1420³.
C₁₈H₁₁NO₂ Isoquinoline, 3,4-dihydro-6,7-methylenedioxy-1-propyl-, 2444².
 Isoquinoline, 1-ethyl-6,7-dimethoxy-, 2444².
 2-Pyrrolidone, 1-benzoyl-4,4-dimethyl-, 819¹.
 —, 1-benzoyl-4-ethyl-, 819¹.
C₁₈H₁₁N₂O₃ Acetic acid, thiocyanato-, carvactyl ester, 4930³; thymyl ester, 4930³.
C₁₈H₁₁NO₃S Benzenesulfonic acid, benzylamine salt, 1895³.
C₁₈H₁₁NO₄ Butyric acid, β-cyano-β-hydroxy-γ-phenoxy-, Et ester, 4481¹.
 1,2(2) - Quinolinedicarboxylic acid, 3,4-dihydro-, 1-Et ester, 1411⁴.
C₁₈H₁₁NO₅ Cinnamic acid, 2,3-dimethoxy-5-nitro-, Et ester, 2160⁴.

- Malonic acid, (α -ethylaminopiperonyl), 1892⁷.
- C₁₃H₁₁NO₇ Protocatechuyl alcohol, α -(α -nitro-ethyl)-, 3,4-diacetate, 5162⁸.
- Pyruvic acid, (3,4-dimethoxy-2-nitro-phenyl)-, Et ester, 2980⁸.
- Syringic acid, acetamido-, acetate, 1405⁷.
- C₁₃H₁₁N₃O₅ Thiazole, 4-methyl-2 (β -tolylhydrazino)-, acetyl deriv., 1410^{8,9}.
- C₁₃H₁₁N₃O₂ Antipyrine, acetamido-, 1471⁷.
- Butyric acid, γ -cyano- α -keto-, Et ester, phenylhydrazine, 834⁴.
- 1,1 - Cyclopentanediacetamide, α , α' - di-cyano-*N*, α -dimethyl-, 110⁷.
- C₁₃H₁₁N₃O₂S *p*-Toluenesulfonanilide, 3' hydrazino-, -HCl, 3909⁹.
- C₁₃H₁₁N₃O₂ 2-Indanpropionic acid, 1-keto-, semicarbazone, 2710^{9,10}.
- Δ^2 - 5 - Pyrazolinecarboxylic acid, 3-methyl-1-phenylcarbamyl-, Me ester, 3704⁸.
- C₁₃H₁₁N₃O₄ Glycine, *N*-(α -methyl-*p*-nitrobenzamido)butyryl-, 1111⁸.
- C₁₃H₁₁N₃O₃S Flavianic acid, MeN deriv., 4702⁸.
- C₁₃H₁₁N₃O₂ Imidazole, 1 butyl, picrate, 1638⁸.
- C₁₃H₁₁N₃S Urea, α -allyl- β -(5-methyl-1-phenyl-1,2,4-triazolyl)thio-, 1610⁷.
- C₁₃H₁₁N₃S₂ Δ -Triazole, 3 (β -allylthiocarbamido)-6-(benzylmercapto)-, 2178⁸.
- 1,2,4 - Triazole, 3 - (β -allylthiocarbamido)-5 - (methylmercapto) - 1 - phenyl 2178⁸.
- C₁₃H₁₁AsN Arsine, cyanocyclohexylphenyl-, 120⁹.
- C₁₃H₁₁As₂Cl₂N₂ 1,1'-Trimethylenbispyridinium dichloroaurate, 93¹.
- C₁₃H₁₁CdO₂S₂ 2-*p*-Cymenecarboxylic acid, dithio-, Cd salt with AcOH, 115⁸.
- C₁₃H₁₁ClNO₂ Alanine, N -(β -chlorobutyl)- β -phenyl-, 2726⁷.
- C₁₃H₁₁Cl₃N₂ 1,1'-Trimethylenbispyridinium dichloride, and *HgCl₂* deriv., 93¹.
- C₁₃H₁₁Cl₂NO₂ Cyclo-2,4,6,7-tetramethylene-1,3,5 - dioxamine, 6 - keto - 2,1,7-tris(α , α , β -trichloropropyl)-, 3662¹.
- C₁₃H₁₁CuO₂S₂ 2-*p*-Cymenecarboxylic acid, dithio-, Cu salt with AcOH, 115⁸.
- C₁₃H₁₁HgNNaO₄ See *Salyrgan*.
- C₁₃H₁₁HgO₂S₂ 2-*p*-Cymenecarboxylic acid, dithio-, Hg salt with AcOH, 115⁸.
- C₁₃H₁₁I₂N₂ Pyrazole, 5-iodo-3-methyl-1-phenyl-, PrI deriv., 4701⁸.
- C₁₃H₁₁N₂ Isopyrrole, 2-[(4,5-dimethyl-2-pyryl-methylene]-3,5-dimethyl-, and *HBr*, 1134⁸.
- Pyrazole, 1-benzyl-3,4,5-trimethyl-, 4700⁸.
- C₁₃H₁₁N₂O 5(10)-Acridone, hexahydro-, oxime, 138⁹.
- Xenylamine, 2',3',4',5' - tetrahydro - *N*-methyl-*N*-nitroso-, 4688¹.
- C₁₃H₁₁N₂O₅ Benzothiazole, 3-methyl-1-propylamino-, acetyl deriv., 835⁸.
- C₁₃H₁₁N₂O₂ Barbituric acid, 5-allyl-5- Δ^2 -cyclohexenyl-, P 483¹.
- Barbituric acid, 1,5,5-triallyl-, 821⁴.
- C₁₃H₁₁N₂O₄ 4-Piperidinol, 1-methyl-, *p*-nitrobenzoate, -HCl, 1902⁷.
- C₁₃H₁₁N₂O₂ Glycoxyamidine, 5-(γ -benzamido-propyl)-, 1621⁸.
- C₁₃H₁₁N₂O₂ Glycine, *N*-[*N*-(phenylcarbamyl)glycyl]glycyl-, 1388⁹.
- C₁₃H₁₁N₄S 1,3,4-Thiooctadiazine, 2-phenylthio-diazino-5,8-dimethyl-, 1401⁸.
- C₁₃H₁₁O Anisole, cyclohexenyl-, 4689¹.
- m*-Cresol, cyclohexenyl-, 4689¹.
- Cyclopentanone, 2-benzyl-5-methyl-, 2702⁸, 2946¹.
- Δ^1 3-Heptenone, 1-phenyl-, 3696⁴.
- Δ^1 3-Hexenone, 5-methyl-1-phenyl-, 3696⁴.
- Phenol, methylcyclohexenyl-, 4689¹.
- C₁₃H₁₁O₂ Benzoic acid, *p*-cyclohexyl-, and *Na salt*, 2917⁸.
- m*-Cresol, butenyl-, acetate, 4690¹.
- Cyclohexanecarboxylic acid, Ph ester, 1454⁴.
- Cyclopentanecarboxylic acid, 1-methyl-, Ph ester, 4155¹.
- Δ^1 3-Hexenone, 5-methyl-1-salicyl-, 3705⁸.
- Naphthaldehyde, ethoxytetrahydro-, P 2446⁹.
- 1-Naphthoic acid, 5,6,7,8-tetrahydro-, Et ester, P 151¹, P 2986⁸.
- Phenol, *p*-cyclopentyl-, acetate, 4689¹.
- C₁₃H₁₁O₂S₂Zn 2-*p*-Cymenecarboxylic acid, dithio-, Zn salt with AcOH, 115⁸.
- C₁₃H₁₁O₂ Cinnamic acid, *p*-butoxy-, 1396⁴.
- Cinnamic acid, *p*-ethoxy-, Et ester, 1396⁹.
- p*-Propoxy-, Me ester, 1396⁹.
- Cyclohexane, 1-(*o*-amyl)oxy-1,2-epoxy-, 2439¹.
- m*-Dioxane, 5-methoxy-2-styryl-, 1403¹.
- 1,3-Dioxolane, 4-(methoxymethyl)-2-styryl-, 1403¹.
- Hydrotubano⁹, mono-Ac deriv., 382⁹.
- Methysticene, tetrahydro-, 2965⁸.
- m*-Naphthoic acid, 5,6,7,8-tetrahydro-3-hydroxy-, Et ester, P 2986⁸.
- C₁₃H₁₁O₂ 1,10-Hendecadene-1,11-dicarboxylic acid, 4439⁷.
- Hydrocinnamic acid, *m*-carboxy- α -methyl-, di-Me ester, 138².
- Hydrotubane acid, Me ether, 382⁷.
- C₁₃H₁₁O₂ Acetoacetic acid, γ -(*m*-methoxy-phenoxy)-, Et ester, 4480⁹.
- Pyruvic acid, (2-ethyl-4,5-dimethoxy-phenyl)-, 843¹.
- C₁₃H₁₁BrN₂ Cycloheptanone, *p*-bromophenylhydrazine, 138⁸.
- C₁₃H₁₁BrN₂O₂ Urea, α -benzyl- β -(α -bromoisovaleryl)-, 2245¹.
- C₁₃H₁₁ClN₂O₂ Diethylamine, *N*-(γ -chloroallyl)-, picrate, 2150⁸.
- C₁₃H₁₁N₂ Aniline, cyclopentenyl *H*, *N*-dimethyl-, and -HCl, 4688^{1,2}.
- Carbazole, hexahydro-3-methyl-, 139⁴.
- Cycloheptanone, 4b,5,6,7,8,9,10 - octahydro-, and -HCl, 138⁹.
- Indoline, 3-isobutyldene-2-methyl-(?), and chloroplatinate, 1635⁸.
- m*-Toluidine, 4,6-diisopropenyl-, and -HCl, 4688^{1,2}.
- Xenylamine, 2',3',4',5' - tetrahydro - *ar*'-methyl-, and chloroplatinate, 4688^{1,2}.
- p*-, 2',3',4',5' - tetrahydro - *N* - methyl-, and -HCl, 4687¹, 4688¹.
- C₁₃H₁₁NO 4-Piperidone, 1-phenethyl-, -HCl, 1902⁷.
- C₁₃H₁₁NO₂ *o*-Acetotoluide, 5-butyryl-, 4457⁹.
- Cinnamamide, *p*-butoxy-, 1396⁹.
- Indoline, 1-acetyl-2-methoxy-3,3-dimethyl-, 3927⁸.
- Isoquinoline, 1-ethyl-3,1-dihydro-6,7-di-methoxy-, 2444¹.
- 2-Naphthoic acid, 3-amino-5,6,7,8-tetrahydro-, Et ester, P 154¹, P 2986⁸.
- 4-Piperidinol, 1-methyl-, benzoate, -HCl, 1902⁷.

- , 6-nitro-, *p*-nitrophenylhydrazone, 4204¹.
 C₁₄H₁₀N₂O₈ Protocatechualdehyde, 6-nitro-, azine, 4204¹.
 C₁₄H₁₀O Anthrol, 4468¹, 4694¹.
 Anthrone, P 611¹.
 1-Phenanthrol, 137¹, 4468¹.
 C₁₄H₁₀O₂ (See also *Benzil*.)
 Acenaphthenequinone, 1,4-dimethyl-, P 2192¹.
 9,10-Anthradiol, 4468¹; *disulfate and derivatives*, P 3110¹.
 Anthrone, hydroxy-, P 2580¹.
 Phenanthrenediol, 3466¹, 4468¹.
 C₁₄H₁₀O₂S Thioxanthone, 2-methoxy-, *perchlorate*, 3706¹.
 C₁₄H₁₀O₂ Benzil, *o*-hydroxy-, 2714¹.
 1(2) - Benzofuranone, 2 - (*p* hydroxyphenyl)-, 832¹.
 Benzoic acid, *o*-benzoyl-, 831¹.
 C₁₄H₁₀O₂S Anthracenesulfonic acid, 1897¹; *N* salt, 3700¹, 3924¹.
 Phenanthrenesulfonic acid, and *K* salt, 4468¹.
 Thioxanthone, 1 (and 4)-hydroxy-4 (and 1)-methoxy-, and salts, 4472¹.
 C₁₄H₁₀O₂ (See also *Benzoyl peroxide*.)
 Benzil, dihydroxy-, 833¹, 2714¹.
 Benzoic acid, *o*-(*p*-hydroxybenzoyl)-, P 1141¹.
 Naphthaleneglyoxylic acid, acetyl-, 1899¹, 3466¹.
 C₁₄H₁₀O₂S Thioxanthone, 2-methoxy-, *S*-dioxide, 1901¹.
 C₁₄H₁₀O₂S₂ Benzoic acid, *m,m'*-trithiobis-, P 1137¹.
 C₁₄H₁₀O₂S₂ Benzoic acid, *m,m'*-tetrathiobis-, P 1137¹.
 C₁₄H₁₀O₂Te Benzoic acid, *o,o'*-tellurobis-, and *di-Na* salt, 2956¹.
 C₁₄H₁₀O₂ Gentianin, 5274¹.
 Naphthalic anhydride, 3,4-dimethoxy-, 4213¹.
 C₁₄H₁₀O₂S 4-Phenanthrenesulfonic acid, 1,2-dihydroxy-, salts, 3466¹.
 Thioxanthone, 1,4 - dihydroxy - 2 (or 3)-methyl-, *S*-dioxide, 1901¹.
 —, 1-hydroxy-4-methoxy-, dioxide, 4472¹.
 C₁₄H₁₀O₂S₂ Phenanthrenedisulfonic acid, 4468¹.
 C₁₄H₁₀O₂S₂ Salicylic acid, 5,5'-trithiobis-, P 1137¹.
 C₁₄H₁₀O₂S₂ Salicylic acid, 5,5'-tetrathiobis-, P 1137¹.
 C₁₄H₁₀O₂Se Salicylic acid, 5,5'-selenobis-, 2159¹.
 C₁₄H₁₀O₂ Acid, *m*. above 250°, from 6-(*p*-carboxyphenyl)hemipic acid, 4222¹.
 C₁₄H₁₀O₂ Digallic acid, 986¹.
 C₁₄H₁₀Br Ethylene, 2-bromo-1,1-diphenyl-, 3920¹.
 C₁₄H₁₀BrHgO₂ Phenol, (acetoxymercuri)-2-bromo-4-phenyl-(2), 830¹.
 C₁₄H₁₀BrO Benzophenone, bromomethyl-, 129¹, 4943¹.
 C₁₄H₁₀Br₂N₂O₂ Benzaniside, dibromo-, 3675¹.
 C₁₄H₁₀Br₂N₂O Anisoyl bromide, 2,4-dibromophenylhydrazone, 3680¹.
 C₁₄H₁₀Br₂N Di-*p*-tolylamine, tetrabromo-, 3709¹.
 C₁₄H₁₀ClN₂O₂ Piperonal, 6-chloro-, phenylhydrazone, 4204¹.
 C₁₄H₁₀ClN₂O₂ Aniline, *N*-(5-chlorovanillal)-*m*-nitro-, 4450¹.
 C₁₄H₁₀ClO Acetophenone, *o*-chloro-*o*-phenyl-, 4692¹.
 C₁₄H₁₀Cl₂NO Acetanilide, (3,5-dichlorophenyl)-, 4450¹.
 C₁₄H₁₀Cl₂NO₂ Anilide, *p*-chloro-*N*-(5-chlorovanillal)-, 4456¹.
 C₁₄H₁₀Cl₂N₂O₂ Diphenylamine, dichloro-1-ethoxy-2',4'-dinitro-, 3910¹, 3911¹.
 C₁₄H₁₀Cl₂N₂O₂ 2,5-Xylydine, 3,4,6-trichloro-, picrate, 3674¹.
 C₁₄H₁₀Cl₂F₂N₂O₂ + 7H₂O, 2116¹.
 C₁₄H₁₀I Stilbene, 4-iodo-, 2170¹.
 C₁₄H₁₀INO₂ Phenol, 4,4'-(*β*-aminoethylidene)-bis[2,6-diiodo-, 3690¹.
 C₁₄H₁₀N Acridine, 5-methyl-, 3920¹.
 Anthramine, P 2987¹, 3706¹, 4694¹.
o-Tolunitrile, *o*-phenyl-, 2710¹.
 C₁₄H₁₀NO Acridone, 10-methyl-, 4219¹.
 Phenanthrol, amino-, and -HCl, 1899¹, 3465¹.
 C₁₄H₁₀NO₂ Phthalimidine, 2-(*m*-hydroxyphenyl)-, 1462¹.
 C₁₄H₁₀NO₂ Benzoic acid, *o*-(*p*-aminobenzoyl)-, P 1419¹.
 Benzophenone, 4-methyl-3-nitro-, 129¹, 838¹, 4687¹.
 Ether, methyl 3-nitro-2-fluoryl-, 5180¹.
 Ethylene oxide, *α*-(*p*-nitrophenyl)-*β*-phenyl-, 3919¹.
 C₁₄H₁₀NO₂ Anthraquinone, 1,2,3,4-tetrahydro-5 (and 6)-nitro-, P 2189¹.
 Benzil, 2,4-dihydroxy-, oxime, 833¹.
 C₁₄H₁₀NO₂S₂ Thianthrene, 2,3-dimethoxy-6-nitro-, 3469¹.
 C₁₄H₁₀NO₂ Benzoic acid, hydroxy-, *p*-nitrobenzyl ester, 3454¹.
 Benzoic acid, (*p*-nitrobenzoyloxy)-, 3454¹.
 Salicylic acid, *p*-nitrobenzyl ester, 3454¹.
 C₁₄H₁₀NO₂S Benzoic acid, (*p*-nitrobenzylsulfonyl)-, 827¹.
 Benzoic acid, *o*-sulfonyl-, *p*-nitrobenzyl ester, 827¹.
 C₁₄H₁₀N₂S 2(1)-Benzisothiazolone, 1-benzylthio-, 4701¹.
 C₁₄H₁₀N₂O Phthalaz-1-one, amino-3-phenyl-, 1454, 1461¹.
 1(2)-Phthalazone, 2-(aminophenyl)-, 146 and -HCl, 1454¹.
 C₁₄H₁₀N₂O₂ Benzoic acid, *β*-*p*-thiocyanophenylhydrazide, 2245¹.
 C₁₄H₁₀N₂O₂ Carbazole, 3-acetamidomethyl-, 3226¹.
 Hydrazine, *α*-benzal-*β*-*p*-nitrobenzyl-, 3665¹.
 C₁₄H₁₀N₂O₂ Phthalide, 2-[*β*-(nitrophenyl)hydroxymethyl]-, 1457, 1460¹.
 Piperonal, *p*-nitrophenylhydrazone, 508¹.
 —, 6-nitro-, phenylhydrazone, 4204¹.
 C₁₄H₁₀N₂O₂ Acetanilide, 2,6-dinitro-4-phenyl-, 830¹.
 C₁₄H₁₀N₂O₂ 1,3,4 - Thiodiazole, 2 - (*p*-nitrophenyl) - 6 - *β* - phenylhydrazono -, 140¹.
 C₁₄H₁₀N₂O₂ 1,3,4-Thiodiazole, 2-amino-5-phenylazo-, 1398¹.
 C₁₄H₁₀N₂O₂ Quinone, 4-cyano-2-nitrophenylhydrazone, semicarbazone, 4674¹.
 C₁₄H₁₀N₂O₂ Benzoxazole, 1-guanido-, picrate, 4449¹.
 C₁₄H₁₀ (See also *Stilbene*.)
 Anthracene, dihydro-, 3697¹, 4468¹, 4695¹.
 Ethylene, diethyl-, 2081¹.
 Phenanthrene, 9,10-dihydro-, 3703¹.
 C₁₄H₁₀As₂N₂O₂ Aniline, 2,2' - arsenobis[4,5-methylenedioxy-, 3677¹.
 C₁₄H₁₀BrClN₂O₂ (*o* - Chlorophenylazo) - 2,5-dimethoxybenzenedisodium bromide, P 1449¹.
 C₁₄H₁₀Br₂NO Benzophenone, aminobromo-methyl-, 1801¹.

- $C_{11}H_{11}BrNO_2$ Acetanilide, *p*-(*p*-bromophen-
oxy)-, 4460⁷.
- $C_{14}H_{11}Br_2$ Anthracene, dibromotetrahydro-
4695¹.
m,m'-Bitolyl, 4,4'-dibromo-, 2170⁴.
- $C_{11}H_{11}Br_2NO_2$ Anisaldehyde, 3,5-dibromo-2-
hydroxy-, phenylhydrazine, 4682¹.
Anisole, *o,o'*-azobis[4-bromo-, 4456⁵.
- $C_{11}H_7Br_2NO_2$ Anisole, *o,o'*-azoxybis[4-bromo-,
4456⁵.
- $C_{11}H_7ClNO$ Benzophenone, 3-amino-4'-chloro-
4-methyl-, 130².
- $C_{14}H_7ClNO$ Phenol, *p*-(5-chlorovanillalamino)-,
4456¹.
- $C_{11}H_7ClNO_2$ 2 - Methyl - 1 - phenylbenzo-
thiazolium perchlorate, 1427.
- $C_{11}H_7ClN_2O$ Acetanilide, 2-chloro-4-phenylazo-,
824¹.
- $C_{14}H_7ClN_2O_2$ Anthranilic acid, *N-p*-chloroben-
zoyl-, hydrazide, 836¹.
2,4,1 - Benzoxaz - 1 - one, 6 - chloro - 3 - hy-
drazino - 3,4 - dihydro - 3 - phenyl-,
828².
- $C_{11}H_7ClN_2O_2$ 6 - Methoxy - 7 - (*p* - nitrophenyl
azo) - *m* - toluenediazonium chloride, P
1649¹.
- $C_{11}H_7Cl_2$ *m,m'*-Bitolyl, 4,4'-dichloro-, 2170⁴.
- $C_{11}H_7Cl_2NO_2$ Anisole, 4,4'-azoxybis[2-chloro-,
2953².
- $C_{14}H_7Cl_2NO_2$ Hydrazine, *s*-bis(4-chloroan-
thranoyl)-, 828².
- $C_{11}H_7Cl_2NO_2$ *p*-Phenetidine, 2,5-dichloro-,
victrate, 3911².
- $C_{11}H_7Cl_2I_2$ *m,m'*-Bitolyl, 4,4'-diiodo-, tetra-
chloride, 2170⁴.
- $C_{11}H_7Cl_2IO_2$ *m,m'*-Bianisole, 6,6'-diiodo-, tetra-
chloride, 2170⁴.
- $C_{11}H_7FN_2O_2$ Anisaldehyde, 2-fluoro-, *p*-nitro-
phenylhydrazine, 5177⁴.
Benzaldehyde, 4-fluoro-2-methoxy-, *p*-
nitrophenylhydrazine, 5177⁴.
- $C_{11}H_7I_2$ *m,m'*-Bitolyl, 4,4'-diiodo-, 2170⁴.
- $C_{11}H_7I_2O_2$ *m,m'*-Bianisole, 6,6'-diiodo-, 2170⁴.
- $C_{11}H_7K_2O_8$ Toluene-sulfonic acid, sulfonyl-
[hydroxy-, di-K deriv., *di-K salt*, 390⁴.
- $C_{11}H_7N_2$ (See also *Orexin*.)
Benzimidazole, 1-benzyl-, 1637².
Cinnoline, 1,2-dihydro-4-phenyl-, 4700².
Quinoxaline, dihydrophenyl-, P 2785².
- $C_{11}H_7NO$ 2 - Benzimidazolecarbinol, *α* phenyl-,
141².
Carbazole, 3-acetamido-, 3226¹.
Compd., m. 209-10°, from 2-phenylsato-
gen, 2969⁶.
1,2-Diazetidone, 1,2-diphenyl-, 4454⁴.
Phthalimidine, 2-(*m*-aminophenyl)-, 146¹.
3-Pseudoindolol, 2-amino-3-phenyl-, 2974⁴.
- $C_{11}H_7NO_2$ Carbanilic acid, dithio-, anhydride
with carbanilic acid, 2953¹.
- $C_{11}H_7NO_2$ Acetanilide, 4-nitro-2-phenyl-, 830¹.
Benzoic acid, *o*-(*p*-anisylazo)-, 4679².
Benzophenone, aminomethylnitro-, 129².
Salicylic acid, 5-phenylazo-, Me ester,
1203⁴.
- 5-*o* tolylazo-, 3913².
- $C_{11}H_7NO_2$ Anthranilic acid, *N*-(5-nitro-*o*-
tolyl)-, 1131⁴.
p Benzamide, 2'-nitro-, 5173².
- $C_{11}H_7NO_2$ [1(2),2'-B(benzosulfonazo)]-, 1'.
2'-dihydro-, 4680².
- $C_{11}H_7NS$ Benzylamine, *N-p*-thiocyanophenyl-,
2245⁴.
- $C_{11}H_7NNa$ Benzimidazole, Na salt, 590².
- $C_{11}H_7N_2O$ Hydrazomethylene, 1-*o*(and *p*-
tolylazo - 2 - phenyl - 1,3 - endoxy-,
4939².
Tetrazole, 1-*o*(and *p*-tolyl-4-phenyl-3,5-en-
doxy-, 4939².
- $C_{11}H_7N_2O_2$ Anthraquinone, 1,4,5,8-tetraam-
ino-, 1273¹.
- $C_{11}H_7N_2O_2$ Anisaldehyde, 2,6-dinitrophenylhy-
drazine, 598².
- $C_{11}H_7N_2O_2$ Compd., m. 250° (decompn.), from
diazotized 2,4 (O:N).C₆H₄NH₂ and iso-
eugenol, 3676¹.
- $C_{11}H_7N_2S$ 6,7 - Benz - 1,3,4 - thioheptadiazine,
2-phenylhydrazino-, 139².
1,3,1 - Thiodiazole, 2-phenyl 5-β-phenyl-
hydrazino-, 140².
- $C_{11}H_7N_2O_2$ Glycol, *o*-nitrophenylsulfone, 380².
- $C_{11}H_7Na_2O_2$ *m*-Cresol, sulfonyl-, di-Na
deriv., 3900².
- $C_{11}H_7O$ 2-1- Anthracenone, 3,4-dihydro-, 4694².
Benzophenone, *p*-methyl-, 129², 4687².
Ether, 2-fluoromethyl-, 5179².
1-*α*-Naphthylidene, 5-methyl, P 1416².
Phenanthrene, dihydro-, 3703².
- $C_{11}H_7O$ (See also *Benzoin*; "benzylester" under
Benzoin acid.)
Acetic acid, diphenyl-, *K salt*, 4942².
Benzaldehyde, *p*-(benzyl-), 1397¹.
Benzophenone, *p*-methoxy-, 318².
α-Tolonic acid, Ph ester, 4451².
α-phenyl-, 2780².
- $C_{11}H_7OS$ Benzyl alcohol, *o*-mercapto-, benzo-
ate, 2164¹.
- $C_{11}H_7OS$ 1,5 - Naphthylenedimercaptan, *α*-di-
acetate, 1634⁴.
- $C_{11}H_7O_2$ Acetophenone, 2,4-dihydroxy-*α*-
phenyl-, 843².
Benzoic acid, 5405².
Furancrylic, benzyl ester, 3993².
Propionic acid, β-naphthyl-, 3703².
- $C_{11}H_7OS$ Benzoic acid, *o*-(*p*-anisylmercapto)-,
3706².
- $C_{11}H_7O$ (See also *Pterocarpon*.)
Benzoic acid, *o*-hydroxy-, 2714⁴.
Cotone, 830².
Isocotone, 830².
Phloracetophenone, *α*-phenyl-, 2162¹.
Resorcylic acid, benzyl, P 1217².
 $C_{11}H_7O_2$ Benzoic acid, 2,4'-dihydroxy-, 2714⁴.
Phloracetophenone, 4'-methoxy-, 2162¹.
1-methyl-ferone, 3,6-diethyl-5-methyl-, 829².
- $C_{11}H_7O_2S$ Thiochromone, 2,3-dihydroxy 6-
methyl-, diacetate, 2140².
- $C_{11}H_7O_2S$ Benzoic acid, *o*-(dihydroxytolylsul-
fonyl)-, 1901².
- $C_{11}H_7O_2S$ Phenanthrenedisulfonic acid, 9,10-
dihydro-, *Li Na salt*, 3703².
- $C_{11}H_7AsClN$ Phenarsazine, 1-chloro 1,6-dihy-
dro 2,10- or 1,8-dimethyl-, 347⁴.
- $C_{11}H_7AsIN$ Phenarsazine, 1,6-dihydro 1-iodo-
2,10 or 4,8'-dimethyl-, 4474².
- $C_{11}H_7AsNO_2$ 5-Benzimidazolecarboxylic acid, 2-
methyl 1-phenyl-, 2951².
- $C_{11}H_7AsNO_2$ Benzenearsonic acid, 3-acetamido-
4-(2,4'-dinitroamino)-, 2954².
- $C_{11}H_7AsNO_2$ Glycine, *N* [*p*-(*p*-hydroxyphenyl-
arsenophenyl) - *HCl*], 119².
- $C_{11}H_7AsNO_2$ Acetic acid, [*p*-(3-amino 4-hy-
droxyphenylarsenophenyl)-], 119².
- $C_{11}H_7BrN$ Benzaldehyde, (*p*-bromophenyl)
methylhydrazine, 1100².
- $C_{11}H_7BrNO_2$ Anisaldehyde, 5-bromo-2-hy-
droxy-, phenylhydrazine, 4681².
- $C_{11}H_7BrNO_2$ 2,3-Quinoxalinecarboxylic acid,
6-bromo-, di-Et ester, 3473².

- C₁₄H₁₃BrN₂S** Carbanilide, bromomethylthio-, 3445⁷.
- C₁₄H₁₃BrO₂** Resorcinol, 4-bromo-6-phenethyl-, 1407¹.
- C₁₄H₁₃ClN₂O** 3,4 - Xylenol, 5 - chloro - 6-phenylazo-, 116⁹.
- C₁₄H₁₃ClN₂O₂** Carbazole, 9-acetyl-6-chloro-1,2,3,4-tetrahydronitro-, 139⁸.
- C₁₄H₁₃ClN₂O₃** 2,3 - Quinoxalinedicarboxylic acid, 6-chloro-, di-Et ester, 3473².
- C₁₄H₁₃ClN₂O₄** Dialuric acid, 5-(chloromethyl)-1,3-dimethyl-, benzoate, 2442⁸.
- C₁₄H₁₃ClN₂S** Carbanilide, chloromethylthio-, 3445⁷.
- C₁₄H₁₃ClO₂** 4,4'-Bi-*o*-cresol, 6-chloro-, 2159⁸. Resorcinol, 4 chloro-6 phenethyl-, 1407¹.
- C₁₄H₁₃Cl₂NO₄** 1,3-Benzodioxan, 6(diacetylamino) - 2,4 - bis(dichloromethyl)-, 2975⁴.
- C₁₄H₁₃Cr₂F₂N₂O₄** + 5H₂O, 2117¹.
- C₁₄H₁₃FN₂O** Anisaldehyde, 2-fluoro-, phenylhydrazone, 5177⁴.
- C₁₄H₁₃Hg₂NO₂** Quinaldine, bis (acetoxymethylmercuri)-, 839⁸. Quinoline, bis(acetoxymethylmercuri)methyl-, 839⁸.
- C₁₄H₁₃IN₂S** Carbanilide, *p* iodo *o*'-methylthio-, 3445⁷.
- C₁₄H₁₃INO₂** Phenol, *p* [4-(*p*-aminoethyl-2,6-diiodophenoxy)-], 1632¹.
- C₁₄H₁₃NO** Aniline, *N*-anisal-, 2951⁸. Benzophenone, 3 aminomethyl-, 839⁸, 4687⁸; and -*III*-, 129⁸. Benzotoluide, 3618⁹. *m*-Cresol, 4-benzalamino-, 1887⁸. 3-Fluorylamine, 2-methoxy-, 5180¹. Phenanthrene, dihydro-, oxime, 3703⁹.
- C₁₄H₁₃NO₂** Acetanilide, *o*-phenoxy-, 4460¹. *m*-Cresol, 4-salicylalmino-, 1887⁸. Indophenol, 2,6 dimethyl-, 3150¹, 3151. Resorcinol, 4-(*α*-iminophenethyl)-, -*III*-, 833¹.
- C₁₄H₁₃NO₂S** Coindoline, 2 (phenylsulfonyl)-, 2176².
- C₁₄H₁₃NO₂S₂** 2-Thianthreneamine, 6,7 dimethoxy-, 3468².
- C₁₄H₁₃NO₂** Acetophenone, 2, 4 - dihydroxy - *α* - phenyl-, oxime, 833¹. 1,2,4-Benzentriol, 6 methyl 3-phenylimino-methyl-, 4478². Compd. m. 92-3°, from anthranilaldehyde and Et α,γ diketovoxylate, 4218⁷.
- C₁₄H₁₃NO₂S** Salicylic acid, (sulfoanilinomethyl)-, P 1511¹.
- C₁₄H₁₃NO₂S₂** Benzenesulfonic acid, 2-(3,4-dimethoxyphenylmercapto) - 5 - nitro-, 3408⁹.
- C₁₄H₁₃NS₂** Benzyl alcohol, *o* phenyl, dithiocarbamate, 2710².
- C₁₄H₁₃N₂O₂** *p*-Tolualdehyde, *p*-nitrophenylhydrazone, 2429⁹.
- C₁₄H₁₃N₂O₃** Anisaldehyde, *p*-nitrophenylhydrazone, 2429⁹. Benzophenone, 5,4'-diamino-4-methyl-3-nitro-, 1301¹.
- C₁₄H₁₃N₂O₄** *p*-Tolualdehyde, 2,3,5-trihydroxy-, *p*-nitrophenylhydrazone, 4478².
- C₁₄H₁₃N₂O₅** Glycine, *N*[*N*(*N*-phthalylglycyl)glycyl]-, 169¹.
- C₁₄H₁₃N₂O** 2,3 - Benzo - 1,4,5,7 - octatetrazine, 6-phenylamino 8-keto-, 379⁸. 2 - Naphthol, (5 - ethyl - 3 - s - triazolyl-azo)-, 2470⁸. 1,2,4 - Triazol - 5(4) - one, 4 - phenyl - 3 - β phenylhydrazino-, 1398⁹.
- C₁₄H₁₃N₂O₂S** Benzanilide, *p*-nitro-, 4-anilino-thiosemicarbazone, 1404¹.
- C₁₄H₁₃N₂O₃** Glycinanilide, picrate, 1112⁹.
- C₁₄H₁₃N₂S** 1,3,4 - Thiodiazole, 2 - anilino - 5 β -phenylhydrazino-, 1398⁹.
- C₁₄H₁₃Na₂O₃S** *m*-Cresol, sulfonylbis-, Na deriv., 3907⁷.
- C₁₄H₁₃** Anthracene, tetrahydro-, 3897⁴. Bibenzyl-, 318¹, 3697⁴, 5360². *p*, *p*'-Bitolyl, 2053⁹. Ethane, *as*-diphenyl-, 90⁹. Methane, phenyltolyl-, 1895⁸. Phenanthrene, tetrahydro-, 2175¹, 3703⁹.
- C₁₄H₁₃AsBr** Arsine, bromodi-*p* tolyl-, 2955².
- C₁₄H₁₃AsBrO₂** Arsine, di-*p*-anisylbromo-, 2955².
- C₁₄H₁₃AsI** Arsine, iododi-*p* tolyl-, 2955².
- C₁₄H₁₃AsN₂O** Arsanilic acid, *N*-(*p*-acetamidophenyl)-5-nitro-, 2954¹.
- C₁₄H₁₃AsN₂O₂** Arsanilic acid, *N*-(3-acetamidophenyl)-3-nitro-, 2954¹.
- C₁₄H₁₃As₂N₂O₂** Acetamide, α -[*p*(*p*-hydroxyphenylarseno)anilino]-, and -*III*-, 116⁹.
- C₁₄H₁₃Br₂N₂O₂** Anisole, *o*, *o*'-hydrazolbis[5-bromo-, 4,4' - Bi - *o* - anisidine, 5,5' - dibromo-, 4456².
- C₁₄H₁₃Br₂N** Stannane, dibromodi-*p* tolyl-, 1188⁹.
- C₁₄H₁₃CaN** Benzamidine, Ca salt, 596².
- C₁₄H₁₃ClNO** Carbazole, 9-acetyl-6-chloro-1,2,3,4-tetrahydro-, 139⁸.
- C₁₄H₁₃ClN** + H₂O See *Acetanilide*.
- C₁₄H₁₃CuN** Benzamidine, Cu salt, 596².
- C₁₄H₁₃CuN₂O₂** + 2H₂O, Ketone, methoxy-, *ox*ime, Cu deriv., 4703¹.
- C₁₄H₁₃Hg** Mercury di-*p* tolyl, 2955², 5172¹.
- C₁₄H₁₃HgO₂** Anisole, *p*, *p*'-mercuribis-, 311¹.
- C₁₄H₁₃K₂O** Bergmann, di K deriv., 3699².
- C₁₄H₁₃N** Cinnohim, 1,2,3,4 - tetrahydro-2-phenyl-, and -*III*-, 4700². Tolualdehyde, phenylhydrazone, 1950¹.
- C₁₄H₁₃N₂O** Benzophenone, 3,3'-diamino-, methyl-, 4687⁸. Cresol, tolylazo-, 2428⁹, 3158⁸. Formic acid, α methyl β , β diphenyl-*o*-azide, 4700². Toluene, azoxybis-, 2171¹.
- C₁₄H₁₃N₂OS** Carbanilide, hydroxymethylthio-, 3445⁷.
- C₁₄H₁₃N₂O₂** Benzoic acid, β *p*-anisylhydrazide, 4938⁹.
- C₁₄H₁₃N₂O₃** Anisole, azoxybis-, 29¹, 300¹, 1703⁹, 2953⁹, 3838⁴, 4385⁵, 4607². Benzylalcohol, *o*, *o*'-azoxybis-, 2163¹. *p*-Tolualdehyde, 2,3,5 trihydroxy-, phenylhydrazone, 4478².
- C₁₄H₁₃N₂O₄** Cyclopentanecarboxylic acid, 2-(*p*-nitrobenzamidomethyl)-, cyclopentanetam, 2427¹. 2,3 - Quinoxalinedicarboxylic acid, di-Et ester, 3473².
- C₁₄H₁₃N₂O₅** 3-Ilydantoinacetic acid, 5-thiethyl-Et ester, 820⁸.
- C₁₄H₁₃N₂O₅S** *p*-Toluenesulfon *p*-anilide, 2-nitro-, 3909⁷.
- C₁₄H₁₃N₂O₅S₂** *p*-Toluenesulfonic acid, 2-hydroxy-5-sulfamyl-, bimol., *ox*ime, 4630¹. Ionylide, 1630⁴.
- C₁₄H₁₃N₂S** Carbanilide, methylthio-, 3445⁷. *o*-Toluic acid, thiono-, β phenylhydrazide, 4938⁹.
- C₁₄H₁₃N₂NaO₂S** See *Methyl orange*.
- C₁₄H₁₃N₂** 2,1,3 - Benzotriazole, 2-(*p*-nitro-methylaminophenyl)-, 836⁸.

- $C_{14}H_{11}N_3O_8$ Salicylaldehyde, 4 - anilinothio semicarbazone, 140⁴.
- $C_{14}H_{11}N_4O_2Zn + H_2O$ Ketone, methyl pyridyl, oxime, Zn deriv., and ZnO compd., 4703¹.
- $C_{14}H_{11}N_4O_2S$ 1,3,4 - Thiothiazole - 2 - mercaptan, 5 - β - phenylhydrazono, tri - Ac deriv., 1398⁴.
- $C_{14}H_{11}N_4O_4$ Hydrazine, β - (dinitro - *m* - tolyl) - α - methyl - α - phenyl-, 1181².
- $C_{14}H_{11}N_4O_8$ Benzylamine, *p* - methoxy, picrate, 4461².
- $C_{14}H_{11}N_4S$ Benzaldehyde, 4 - anilinothiosemicarbazone, 140⁴.
- $C_{14}H_{11}N_5$ *s* - Triazole, 3 - (aminonaphthylazo) 5 ethyl-, 3470².
- $C_{14}H_{11}NaO_4P$ Tollyl phosphate, sodium salt, 1190².
- $C_{14}H_{11}Na_2O_2$ Bergenin, di-Na deriv., 3699⁴.
- $C_{14}H_{11}O$ Anthrol, tetrahydro, 4694⁸.
- Benzohydrol, α - methyl, 4465¹.
- Benzyl ether, 4681².
- Ethanol, 1,2 diphenyl-, 124².
- Ether, phenethyl phenyl-, 1872¹.
- Ketone, 2,6 dimethyl-1 naphthyl methyl-, 3916¹.
- $C_{14}H_{11}OS$ Anisole, *p* - (*p* - tolylmercapto), 2956⁴.
- $C_{14}H_{11}O$ Bisanisole, 5074².
- Coumarin, 3-allyl-4,7-dimethyl-, 2959⁴.
- 6 - Dibenzopyrone, 7,8,9,10 - tetrahydro - 3 - methyl -, 383².
- α , γ , ϵ Heptatrienic acid, β - phenyl, Me ester, 3688⁹.
- Hydrobenzoin, 2335², 5092¹.
- Methane, (benzyloxy)phenoxy, 1871⁹.
- 2 Naphthaleneacetic acid, α , 1 dimethyl-, 3699¹.
- Naphthalenebutyric acid, 3703¹.
- Phenol, 2 benzyl-4-methoxy-, 2955².
- Resorcinol, phenethyl-, 1931².
- $C_{14}H_{11}O_2PbS$ Benzyl alcohol, α mercapto, Pb deriv., 2164¹.
- $C_{14}H_{11}O_2S$ Benzyl alcohol, α , α' thioas-, 2164¹.
- $C_{14}H_{11}O_2S$ Benzyl alcohol, α , α' dithioas-, 2164¹.
- Ethane, *s* - bis(phenylsulfanyl)-, 4202².
- $C_{14}H_{11}O_2Se$ Cresol, selenobis-, 2159⁴.
- $C_{14}H_{11}O_2$ 6-Dibenzopyrone, 7,8,9,10 tetrahydro 3-methoxy-, 383¹.
- α , γ , ϵ - Heptatrienic acid, β - methoxy- β - phenyl-, 2965⁴.
- $C_{14}H_{11}O_2S$ Acetic acid, (ethoxynaphthylmercapto), P 3109⁴.
- Benzohydrol, α - methyl, acid sulfite, Me salt, 5180².
- $C_{14}H_{11}O_4$ 6 - Dibenzopyrone, 7,8,9,10 - tetrahydrodihydroxy-9-methyl-, 383².
- Nadakenetin, 2445².
- Pterocarpin, dihydro-, 2246².
- $C_{14}H_{11}O_4S$ *m* Cresol, sulfonylbis-, 3909⁴.
- $C_{14}H_{11}O_4$ 1,2 - Benzopyran - 3 - carboxylic acid, 6,8 - diethyl - 5 - hydroxy - 2 - keto-, 3210².
- Δ^5 - 2,4 - Hexenedione, 8 - (*m* - hydroxyphenyl)-, methylcarbonate, 4211².
- $C_{14}H_{11}O_4S$ Resorcinol, 4,6-dimercapto-, tetraacetate, 826¹.
- $C_{14}H_{11}O_4$ 2,1 - Benzopyran - 3 - carboxylic acid, 1-keto-5,6,7-trimethoxy-, Me ester, 3699⁴.
- β -Tolualdehyde, 2,3,5-trihydroxy-, triacetate, 4478².
- $C_{14}H_{11}O_4S$ Toluene sulfonic acid, sulfonylbis[hydroxy-, and salts, 3909⁴.
- $C_{14}H_{11}S$ Benzyl sulfide, 36⁴.
- $C_{14}H_{11}AsN_3O_4$ Arsanilic acid, *N*-(α carbamylbenzenearsonic acid, 3-acetamido-4-anilino-, 2954¹.
- $C_{14}H_{11}AsN_3O_2S$ 1,4 - Benzisoxazine - 6 - thioarsinous acid, 8 - acetamido - 3 - hydroxy, di(carboxymethyl) ester, 3677⁸.
- $C_{14}H_{11}AsN_3O_2$ Ethanol, 2 [*p*-(*p*-hydroxyphenyl-arseno)anilino]-, and -HCl, 1192².
- $C_{14}H_{11}AsN_3O$ Acetamide, α [*p*-(*p*-aminophenyl-arseno)anilino]-, di-HCl, 1193².
- $C_{14}H_{11}AsN_3O_2$ Acetamide, α [*p*-(3-amino-4-hydroxyphenyl-arseno)anilino]-, di-HCl, 1194².
- $C_{14}H_{11}BrN_3O$ Barbituric acid, 1-(*p*-bromophenyl)-5,5 diethyl-, 3024¹.
- $C_{14}H_{11}ClN_3O$ Cmeloninamide, 2 chloro-*N*, *N*-diethyl-, P 1217².
- $C_{14}H_{11}ClN_3O$ Barbituric acid, 1-(*p*-chlorophenyl)-5,5 diethyl-, 3024¹.
- $C_{14}H_{11}KO$ Bergenin, K deriv., 3699⁴.
- $C_{14}H_{11}N$ Anthramine, tetrahydro-, 4695².
- $C_{14}H_{11}NO$ 6-Cyclohepta[β]quinolin-11(5) one, 7,8,9,10-tetrahydro-, 138².
- $C_{14}H_{11}NO$ Phenol, *p*, *p'*-(β -aminoethylidene)-bis-, and -HCl, 3690².
- Spiro[cyclopentane - 1,3' - pyrrolidine]-2',5'-dione. 1' phenyl-, 110⁴.
- $C_{14}H_{11}NO_2S$ Methanesulfonamide, *N*-benzyl-, 2127⁴.
- $C_{14}H_{11}NO_2$ 1 - Propanol, 1 - phenyl - 2 - (furfurylloxaminio)-, 4205².
- $C_{14}H_{11}NO_2S$ Di *p*-toluenesulfonamide, 4460¹.
- $C_{14}H_{11}NO_2$ Acetoacetic acid, α cyano γ -(2,3-dimethoxyphenoxy)-, Me ester, 4481¹.
- $C_{14}H_{11}N_2$ Aniline, *N*, *N* dimethyl-*p*-phenylazo-, 4199¹.
- Dimethyl yellow, 1336¹.
- Guandine, methylphenyl-, P 847⁴.
- Methyl yellow, 576¹.
- Toluidine, tolylazo-, 3542².
- $C_{14}H_{11}NO$ Benzyl alcohol, α -(6-amino-*m*-tolylazo)-, 2163².
- Glycine, *N*-phenyl-, β -phenylhydrazide, 145².
- Triazene, 3 (α hydroxy-*o* - tolyl)-1- β -tolyl-, 2163².
- $C_{14}H_{11}NO_2S$ Benzenesulfonamide, *p*-formyl-*N*-methyl-, phenylhydrazono-, 4680².
- Benzosulfonamide, 1,2 dihydro-1-methyl-2- β phenylhydrazono-, 4680².
- Carbazic acid, β -2 naphthylthiocarbamyl-, Et ester, 2953².
- $C_{14}H_{11}NO_2S$ (See also *Methyl orange*)
- Benzenesulfonic acid, *p* (*p*-methylamino-phenylazo)-, Me ester, 4201².
- $C_{14}H_{11}NO_3$ Compd., m. 192², from 2,1-(O₂N)₂C₆H₃NH₂, 3676².
- $C_{14}H_{11}NO_3S$ Carbohydrazide, α -phenyl- β -phenyl-carbamylthio-, 1398².
- $C_{14}H_{11}N_3O_2$ Semicarbazide, 1-(α -carbamidophenyl)-4-phenyl-, 379².
- $C_{14}H_{11}N_3S$ Urea, α -(imino β phenylhydrazino-methyl)- β phenylthio-, 1640¹.
- $C_{14}H_{11}N_3S$ Carbohydrazide, α phenyl- β -phenylthiocarbamylthio-, 1398².
- $C_{14}H_{11}NaO_2$ Bergenin, Na deriv., 3699⁴.
- $C_{14}H_{11}NO$ Norcamphane, 2 benzal, 369².
- $C_{14}H_{11}AsN_3O_4$ Benzenearsonic acid, 4-(*p*-acetamidooanilino)-3-amino-, 2954¹.
- $C_{14}H_{11}AsN_3O_4$ Benzenearsonic acid, 4-(3-acetamido - 4 - hydroxyanilino) - 3-amino-, 2954¹.

- C₁₄H₁₈As₂N₂O Ethanol, 2-[*p*-(*p*-aminophenylarseno)anilino]-, *di-HCl*, 119¹.
- C₁₄H₁₈As₂N₂O₂ Ethanol, 2-[*p*-(3-amino-4-hydroxyphenylarseno)anilino]-, *di-HCl*, 119².
- C₁₄H₁₈BrNO₂ 1-(Carboxymethyl)lepidinium bromide, Et ester, 3022².
- C₁₄H₁₈ClNO₂ 4a, 9a - Carbazole, 9 - acetyl-6 - chloro - 1, 2, 3, 4 - tetrahydro-, 139⁴.
- C₁₄H₁₈ClN₂O₂ Glycine, *N*-[*N*-(*p*-chlorobenzoyl)alanyl]glycyl]-, 4192³.
- C₁₄H₁₈Cl₂O₂ Mucyl chloride, tetraacetate, 4193³.
- C₁₄H₁₈N₂O Δ³-1,2-Cyclopentenedione, 4-iso propyl-, 1-phenylhydrazone, 1624⁹.
- C₁₄H₁₈N₂O₂ Cinchoninamide, 2-ethoxy-*N*, *N*-dimethyl-, P 1217⁸.
- Cinchoninamide, 2-ethoxy-*N*-ethyl-, P 1217⁸.
- C₁₄H₁₈N₂O₂S *p*-Toluenesulfonotoluide, 2-amino-, 3909⁴.
- C₁₄H₁₈N₂O₂ Barbituric acid, 5,5 - diethyl-1-phenyl-, 3024¹.
- C₁₄H₁₈N₂O₂S Thiazole, 2-(*α*-acetamidoisopropyl)-4 - (3,4 - dihydroxyphenyl)-, and -HCl, 3470⁸.
- p*-Toluenesulfonanide, 2-amino-, 3909⁴.
- C₁₄H₁₈N₂O₂ Barbituric acid, 5-(benzyloxy-methyl)-5-ethyl-, 4744².
- C₁₄H₁₈N₂O₂S 1 - (Carboxymethyl)pyridinium sulfate, 3906¹.
- C₁₄H₁₈N₂O₂ Glycine, *N*-[*N*-(*p*-nitrobenzoyl)alanyl]glycyl]-, 4192³.
- C₁₄H₁₈O α,γ-Pentadienaldehyde, α-ethyl-γ-methyl-δ-phenyl-, P 3714⁴.
- C₁₄H₁₈O₂ Phenol, cyclohexenyl-, acetate, 4689⁴.
- C₁₄H₁₈O₂ 2-Naphthoic acid, 1,2,3,4-tetrahydro-1-keto-2-methyl-, Et ester, 137⁴.
- α, γ - Pentadienic acid, δ - *p*-anisyl-, Et ester, 3912³.
- γ - Pentenic acid, α isopropyl - β - keto - δ-phenyl-, 3705⁴.
- Δ¹ - 3 - Pentenone, 4,4 - dimethyl - 1 - (3,4-methylenedioxyphenyl)-, 4942¹.
- C₁₄H₁₈O₂ Caproic acid, *ε*-benzoyl-δ-keto-, Me ester, 4700⁶.
- Cinnamic acid, *p*-carboxy-, di-Et ester, 138¹.
- C₁₄H₁₈O₂ Glycolic acid, dianisyl-, 3910⁴.
- C₁₄H₁₈O₂ 1,2,4-Benzenetriol, 3,6-dimethyl-, triacetate, 4478⁴.
- C₁₄H₁₈O₂ Δ¹-1,2,3,4-Cyclohexenetetracarboxylic acid, 2,3-anhydride, 1,4-di-Et ester, 3674³.
- Malonic acid, [(*m*-methoxyphenoxy)acetyl]-, di-Me ester, 4481¹.
- C₁₄H₁₈O₂ Quinic acid, 4-*p*-hydroxybenzoate, 1632².
- C₁₄H₁₈O₂ Bergenin, 3699⁴.
- C₁₄H₁₈As₂N₂O₂S 1,4-Benzisoxazine-6-thioammonous acid, 8-acetamido-3-hydroxy-, di-(carbamylmethyl) ester, 3677³, 3678³.
- C₁₄H₁₈BrN₂O₂ Alanine, *N*-(*N*-(*α*-bromopropionyl)glycyl)-β-phenyl-, 4233³.
- C₁₄H₁₈ClN₂O₂ Tropase, 3-chloro-, picrate, 2183².
- C₁₄H₁₈ClN₂O₂ Tropase, 3-chloro-, *N*-oxide, picrate, 2183².
- C₁₄H₁₈N Benzonitrile, methylcyclohexyl-, 4690⁴.
- C₁₄H₁₈N₂O Acetanilide, *p*-Δ¹-cyclohexenyl-, 4687⁴.
- Compd., m. 28°, from *o*-cresol and *p*-toluidine, 122².
- Compd., m. 20.5°, from *p*-cresol and *p*-toluidine, 122².
- C₁₄H₁₈NO₂ Benzyl alcohol, α-[α-(furylmethyl-amino)ethyl]-, 4208⁴.
- Isoquinoline, 6,7-dimethoxy-1-propyl-, 2444¹.
- Δ³ - 1 - Pyrrolinopropanol, benzoate, -HCl, 1899².
- C₁₄H₁₈NO₂ Cyclopentaneacetic acid, 1-phenyl-carbamyl-(?), 1104⁴.
- Cyclopentaneacetic acid, 1-(phenylcarbamylmethyl)-(?), 1104⁴.
- 2-Indolinol, 1-acetyl-3,3-dimethyl-, acetate, 3927⁴.
- C₁₄H₁₈NO₂S Benzenesulfonic acid, phenethylamine salt, 1895⁴.
- p*-Toluenesulfonic acid, benzylamine salt, 1895⁴.
- C₁₄H₁₈NO₂ Butyric acid, β-cyano-β-hydroxy-γ-(*m*-methoxyphenoxy)-, 4480⁴.
- C₁₄H₁₈NO₂ Acetic acid, α,α'-dimethyl-α''-phenyl α,α',α''-nitrotris-, 102⁴.
- Sambunigrin, 5215¹.
- C₁₄H₁₈NO₂ 4 - Homopyrocatechol, α-methyl amino-, diacetate, oxalate, 5162⁴.
- C₁₄H₁₈NO₂ Bergenin, amino-, 3699⁴.
- Protocatechyl alcohol, α-(aminomethyl), 3,4-diacetate, oxalate, 5162⁴.
- C₁₄H₁₈N₂O₂ Valeric acid, δ-cyano-α-keto-, Et ester, phenylhydrazone, 834⁴.
- C₁₄H₁₈N₂O₂S *p*-Toluenesulfonotoluide, 2-hydrazino-, -HCl, 3909⁴.
- C₁₄H₁₈N₂O₂ Δ³-3-Pyrazolincarboxylic acid, 4,5 - dimethyl - 1 - phenylcarbamyl, Me ester, 3704⁴.
- C₁₄H₁₈N₂O₂S *p*-Toluenesulfon-*o* aniside, 2-hydrazino-, -HCl, 3909⁴.
- C₁₄H₁₈N₂O₂ *m*-Xylene, 5-cyclohexyl-2,4,6-trinitro-, 4936⁴.
- C₁₄H₁₈N₂O₂ Carbamic acid, *N*, *N'*-(6-nitropiperonylidene)bis-, di-Et ester, 1404⁴.
- C₁₄H₁₈ Phenanthrene, 1,2,3,4,5,6,7,8-octahydro-, 3703¹.
- C₁₄H₁₈As₂N₂O₂S Xanthic acid, (3-acetamido-4-hydroxyphenylarsenyl) deriv., P 1649⁴.
- C₁₄H₁₈BrNO₂ Alanine, *N*-(*α*-bromoisovaleryl)-β-phenyl-, 1112³.
- C₁₄H₁₈HgO₂ Resorcinol, anhydromercuri acetoxymercuriethyl-, 1401³.
- C₁₄H₁₈N₂ Pyrazole, 1-benzyl-4-ethyl-3,5-dimethyl-, 4701¹.
- C₁₄H₁₈N₂O Aniline, *N*-methylmethylcyclohexenyl-*N*-nitroso-, 4690⁴.
- C₁₄H₁₈N₂O₂ 6,12(5,11) - Phenhomazinedione, 1,4,4a,6a,7,10,10a,12a - octahydro-, 2958¹.
- C₁₄H₁₈N₂O₂ 1-Piperazinecarboxylic acid, 4-benzoyl-, Et ester, 2183².
- C₁₄H₁₈N₂O₂S 2 - Naphthalenesulfonic acid, 7-(δ-aminobutylamino)-, P 848⁴.
- C₁₄H₁₈N₂O₂ Asparagine, *N*α-isopropylbenzoyl-, 1620².
- 4-Piperidinol, 1-ethyl-, *p*-nitrobenzoate, -HCl, 1902².
- Valine, *N*-(*N*-benzoyl)glycyl)-, 1380⁴.
- C₁₄H₁₈N₂O₂ Quinoxaline, 2,3-dimethyl-, and with dimethylglyoxime, 2978³.
- C₁₄H₁₈N₂O₂S Benzyl alcohol, α-anilino-, acid sulfate, guanidine salt, 5171¹.
- C₁₄H₁₈N₂O₂ Isopelletierine, picrate, 1132².
- C₁₄H₁₈O Acetophenone, *p*-cyclohexenyl-, 2947².
- 2 - Anthrol, 1,2,3,4,5,6,7,8 - octahydro-, 4693¹.
- Cinnamaldehyde, α-amyl-, P 1142³.
- Jasminaldehyde, 1468⁴.

- 2-Norcamphanecarbinol, α -phenyl-, 3692².
 C₁₁H₁₅O₂ Cyclohexanecarboxylic acid, 1-methyl-, Ph ester, 4455⁴.
 1,2-Cyclopentanediol, 1-phenyl-, acetone compd., 2701⁴.
 Phenol, *p*-cyclohexyl-, acetate, 4689⁴.
 C₁₁H₁₅O₂ Cinnamic acid, *p*-butoxy-, Me ester, 1396².
 Cinnamic acid, *p*-propoxy-, Et ester, 1396². Δ^1 -1,2-Cyclohexenedicarboxylic anhydride, 4- Δ^3 -isohexenyl-, 3692².
 Enanthic acid, β -benzoyl-, 4706⁷.
 α -Heptenic acid, β -methoxy- β -phenyl-, 2966¹.
 1-Hexene, 2-methoxy-6-(methylenedioxyphenyl)-, 2965⁴.
 2,3-Naphthalenedicarboxylic anhydride, 1,2,3,4,5,6,7,8-octahydro-5,5-dimethyl-, 3692².
 C₁₁H₁₅O₂S Anthracenesulfonic acid, octahydro-, 4021².
 C₁₁H₁₅O₄ Adipic acid, α -benzyl- δ -methyl-, 2946².
 Benzenediacetic acid, di-Et ester, 137⁴.
 Cinnamic acid, 3,4-dimethoxy- β -methyl-, Et ester, 842².
 Hydrocinnamic acid, *o*-carboxy-, di-Et ester, 137⁴.
 C₁₁H₁₅O₂ Cinnamic acid, 2,3-diethoxy-4-methoxy-, 2718⁷.
 C₁₁H₁₅O₂ Glucose, tetraacetyl-, 105⁴, 2942².
 C₁₁H₁₅O₁₀ *d*-Gluconolactone, tetraacetyl-, 2942².
 C₁₁H₁₅AsN₂O₂S₂ 1,4-Benzisoxazine-6-thioarsinous acid, 8-acetamido-3-hydroxy-, di(β -hydroxyethyl) ester, 3677⁴.
 C₁₁H₁₅BrO₂ *d*-Glucose 6-bromohydrin, α -tetraacetyl-, 105⁴.
 C₁₁H₁₅ClO₂ Fructose, tetraacetylchloro-, 2426².
 β -D-Mannose-6-chlorohydrin, tetraacetyl-, 4933².
 C₁₁H₁₅Cl₂N₂O 2-Propanone, 1,3-dichloro-4-carvacrylsemicarbazone, 5470².
 C₁₁H₁₅IN₂ Isopyrazole, 3,4,4,5-tetramethyl-, benzyl iodide deriv., 4700².
 C₁₁H₁₅IN₂S Pseudothiohyprine, PrI deriv., 4701².
 C₁₁H₁₅IO₂ Glucose 6-iodohydrin, tetraacetyl-, 105⁴, 106⁴.
 C₁₁H₁₅N Aniline, *N,N*-dimethylmethylcyclopentenyl-, 4690².
 Aniline, *N*-methylmethylcyclohexenyl-, and -HCl, 4690².
 Anthramine, octahydro-, 4695².
 "Cyclohepta(β)quinoline, 5,5a,7,8,9,10,10a,11-octahydro-, 138⁴.
 Xenylamine, 2',3',4',5'-tetrahydro-*N,N*-dimethyl-, and -HCl, 4688⁴.
 C₁₁H₁₅NO Acetanilide, *p*-cyclohexyl-, 2947².
 Heptamethylenimine, 1-benzoyl-, 387⁴.
 Penteno-*p*-toluide, dimethyl-, 96¹.
 Piperidine, 1-benzoyl-4,4-dimethyl-, 4673².
 C₁₁H₁₅NO₂ *o*-Acetotoluide, 5-isovaleryl-, 4457².
 Δ^1 -2-Hexenol, 3-benzyl-, carbamate, P 3476².
 Isoquinoline, 3,4-dihydro-6,7-dimethoxy-1-propyl-, 2444¹.
 4-Piperidinol, 1-ethyl-, benzoate, -HCl, 1902⁷.
 1-Pyrrolidinepropanol, benzoate, -HCl, 1890⁷.
 C₁₁H₁₅NO₂ 2-Indolecarboxylic acid, 4,5,6,7-tetrahydro-4-keto-3,6,6-trimethyl-, Et ester, 2718⁷.
 C₁₁H₁₅NO₂ Piperonylic acid, β -diethylaminoethyl ester, -HCl, 5230².
 C₁₁H₁₅NO₂ 8-Pyrrolepropionic acid, 2,5-dicarboxy-4-methyl-, di-Et ester, 1134⁴.
 C₁₁H₁₅N₂O Alanine, *N*-(*N*-alanylglycyl)- β -phenyl-, 4233¹.
 Glycine, *N*-(*N*-phenylcarbamylyl)-, 1618².
 Levulinic acid, α,α,β -trimethyl-, *p*-nitrophenylhydrazone, 111¹.
 Valine, *N*-(*N*-phenylcarbamylyl)-, 1389².
 C₁₁H₁₅Xylene, cyclohexyl-, 4936⁴.
 C₁₁H₁₅AsNO₂S₂ Phenylthioarsinous acid, 4-amino-, di(carbethoxymethyl) ester, and -HCl, 3677².
 C₁₁H₁₅BrN Compd, m. 95°, from cyclohexenyl-dimethylaniline and HBr, 4688².
 C₁₁H₁₅FeN₂ + 6H₂O, 3638⁴.
 C₁₁H₁₅HgO₂ Resorcinol, (acetoxymethyl)hexyl-, 1401².
 C₁₁H₁₅IN (Cyclopentenylphenyl)trimethylammonium iodide, 4688².
 C₁₁H₁₅N₂ Hydrazine, α -methyl- α -(methylcyclohexenylphenyl)-, 4690⁷.
 Pyrrole, 1,1'-ethylenebis[2,5-dimethyl-, compd. with SnCl₄], 2968⁷.
 C₁₁H₁₅N₂O₂ 4-Piperidinol, 1-ethyl-, *p*-aminobenzoate, -HCl, 1902⁷.
 C₁₁H₁₅N₂O₂ Δ^1 -Cyclohexanecarboxylic acid, 6-(6-amino- Δ^3 -cyclohexenylcarbonylamino)-, and Cu deriv., 2958¹.
 1-Piperazineethanol, β -methyl- α -(3,4-methylenedioxyphenyl)-, 4473¹.
 C₁₁H₁₅N₂O Heptylamine, *N*-(4,5-methylenedioxy-2-nitrophenyl)-, 4204⁴.
 Pentanol, dimethylamino-, *m*-nitrobenzoate, P 4483⁴.
 C₁₁H₁₅N₂O₂ 1-Piperazinecarboxylic acid, 4-*p*-tolylsulfonyl-, Et ester, 2183².
 C₁₁H₁₅N₂O₂ Piperidine, 2,2,6-trimethyl-, picate, 92².
 C₁₁H₁₅N₂O₂ α -Ethoxyallyltrimethylammonium picate, 2150⁴.
 C₁₁H₁₅N₂O₂ Triethyl(formylhydroxymethyl)ammonium picate, 2150⁷.
 C₁₁H₁₅N₂O₂S₂ [4,4'-Bi- Δ^2 -pyrazoline]-1,1'-dicarboxamide, *N,N'*-diethyl-5,5'-diketo-3,3'-dimethyldithio-, 388².
 C₁₁H₁₅O Acetophenone, diisopropyl-, P 1649⁴.
 Caprophenone, α,α -dimethyl-, 125⁴.
 Phenole, *o*(and *p*)-cyclohexyl-, 4937^{1,2}.
 C₁₁H₁₅O₂ Compd, b_p 240°, from ethylenedibisphenol, 4690².
 Δ^1 -Cyclohexenecarboxylic acid, 4-isopropenyl-, Et ester, 2248¹, 4942².
 C₁₁H₁₅O₂ Δ^1 -1,2-Cyclohexenedicarboxylic anhydride, 4-isohexyl-, 3692².
 C₁₁H₁₅O₄ Δ^1 -1,2-Cyclohexenedicarboxylic acid, 4- Δ^3 -isohexenyl-, 3692².
 2,3-Naphthalenedicarboxylic acid, 1,2,3,4,5,6,7,8-octahydro-5,5-dimethyl-, 3692².
 Resorcylic acid, heptyl-, P 1217³.
 C₁₁H₁₅O₂ Malonic acid, ethyl(2-furylmethyl)-, di-Et ester, 5472⁷.
 C₁₁H₁₅O₂ Δ^1 -1,2,3-Cyclopentenetricarboxylic acid, tri-Et ester, 4677⁴.
 C₁₁H₁₅O₂ 1,1,3,3-Cyclobutanetetracarboxylic acid, 2,2-dimethyl-, tetra-Me ester, 1398².
 1,3-Cyclohexanediol, mixed Et oxalate ester, 4677².
 C₁₁H₁₅O₂ Shibuol, 2175².
 C₁₁H₁₅O₁₀ Fructose, tetraacetyl-, 2426².
 Glucose, tetraacetyl-, 4932².
 Mannose, tetraacetyl-, 4933².

- C₁₄H₂₀O₁₁** Compd., m. turbid 116°, clear 118°, from tetraacetyl-1,2-glucose, 20431.
- C₁₄H₂₁AsN₃O₄** 1-Propanearsonic acid, 3-(4-benzoyl-1-piperazyl)-, 92°.
- C₁₄H₂₁AsN₃O₄** Benzenearsonic acid, 3,5-bis(butyrylamino)-4-hydroxy-, 1400°.
- C₁₄H₂₁HgNO₂** Aniline, *p*-(acetoxymethyl)-*N*, *N*-dipropyl-, 1888°.
- C₁₄H₂₁N** Aniline, *p*-isohexenyl-*N*, *N*-dimethyl-, 4689°.
- C₁₄H₂₁NO** Hydrocinnamamide, *N*, *N*-diethyl *p*-methyl-, 2697°.
- C₁₄H₂₁NO₂** (See also *Stovaine*)
Diethylamine, *p*-(6-allyl-*o*-anisyl-oxy)-, P 4777°.
- 3-Pentanol, 2,4-dimethyl, carbagulate, 2420°.
- 1-Propanol, 1-phenyl-2-(isoamylideneoximino)-, 4205°.
- α*-Toluic acid, *β*-diethylaminoethyl ester, -HCl, 5236°.
- C₁₄H₂₁NO₂** Anisic acid, *β*-diethylaminoethyl ester, -HCl, 5236°.
- Butyramide, *N*-(3,4-dimethoxyphenethyl), 2444°.
- Piperonyl alcohol, *α*-(*α*-diethylaminoethyl), and -HCl, 2162°.
- 2-Pyrrolecarboxylic acid, 4-isovaleryl-3,5-dimethyl-, Et ester, 2185°.
- C₁₄H₂₁NO₄** 3-Pyrrolepropionic acid, 5-carboxy-2-(ethoxymethyl)-4-methyl-, 5 Et ester, 1133°.
- C₁₄H₂₁N₃O** Acetone, 4-carbacylsemicarbazone, 5470°.
- Acetophenone, *tert*-butylmethyl-, semi carbazone, 2431°.
- C₁₄H₂₂** 6,8-Tetradecadiene, 2930°, 2931°, 4439°.
- C₁₄H₂₂AsNO₂** Arsine, (3-acetamido-4-hydroxyphenyl)bis(*β*, *γ*-dihydroxypropylmercapto)-, P 1619°.
- C₁₄H₂₂BrHgN** Aciline, *p*-(bromomethyl)-*N*, *N*-dibutyl-, 1889°.
- C₁₄H₂₂ClHgN** Aniline, *N*, *N*-dibutyl-*p*-(chloromethyl)-, 1889°.
- C₁₄H₂₂Cl₂O₁₁Pb₂**, 2842°.
- C₁₄H₂₂CoO₄** 2,4-Heptanedione, Co deriv., P 600°.
- C₁₄H₂₂HgIN** Aniline, *N*, *N*-dibutyl-*p*-(iodomercuri)-, 1889°.
- C₁₄H₂₂IN** (*p*-Cyclohexylphenyl)trimethylammonium iodide, 4654°.
- C₁₄H₂₂INO₂** Carnegine, methiodide, 4222°.
- C₁₄H₂₂MoO₄** Molybdenyl bisdipropionylmethane, 1887°.
- Molybdenyl bis 3-ethylacetylacetone, 1877°.
- C₁₄H₂₂N₂** 2-Butanone, carbacylhydrazide, 5470°.
- C₁₄H₂₂N₂O** Benzaldehyde, *p*-[(*γ*-diethylaminoethyl)methylamino]-, P 600°.
- Benzaldehyde, *p*-[(*γ*-dimethylamino-*α*-methylpropyl)methylamino]-, P 600°.
- C₁₄H₂₂N₂O₂** Urea, *α*-phenyl-*β*-(*γ*-propoxybutyl)-thio-, 4669°.
- C₁₄H₂₂N₂O₂** (See also *Tulocaine*)
Anisaldehyde, oxime, diethylaminoethyl deriv., P 4301°.
- 2-Butanol, 4-dimethylamino-3-methyl-, *p*-aminobenzoate, 1404°.
- 6,12(5,11)-Phenothiazinedione, dodecahydron-, 2958°.
- C₁₄H₂₂N₂O₄** Lyxonic acid, 2,3,4-trimethyl-, phenylhydrazide, 1881°, 2423°.
- Xyloic acid, trimethyl-, phenylhydrazide, 2423°.
- C₁₄H₂₂N₄O₄** Tetramethylammonium picrate, 3617°.
- C₁₄H₂₂O** Aromadendrone, 139°.
- Δ*²-2-Butenone, 4-(2,2,4,6-tetramethyl-*Δ*²-cyclohexenyl)-, 3692°.
- Compd., bis 143-4°, from crotonaldehyde and *α*-phellandrene, 3692°.
- Δ*²-Cyclohexenealdehyde, 3-*Δ*²-isohexenyl-6-methyl-, 3692°.
- C₁₄H₂₂O₂** Ketone, bis 225-30°, from compd. m. 140-6°, 4690°.
- 1,2-Pentandiol, 1-phenyl 2-propyl-, 1892°.
- C₁₄H₂₂O₂** Geraniol, ester with allyl acid carboxylate, 124°.
- C₁₄H₂₂O₂** *Δ*²-1,2-Cyclohexene-dicarboxylic acid, 4-isohexyl-, 3692°.
- C₁₄H₂₂O₂** Glucoside, 3,4,6-triaceto-2-methylmethyl-, 3672°.
- Glucoside, 3,4,6-triacetyl-*β*-ethyl-, 1881°.
- C₁₄H₂₂BrO₄** 1,1-Cyclopentenediacetic acid, *α*-bromo-*α'*-methyl-, di-Et ester, 111°.
- C₁₄H₂₂IN** Aniline, *p*-isobutenyl-*N*, *N*-dimethyl-, dimethiodide, 4689°.
- C₁₄H₂₂NO** Aromadendrone, oxime, 139°.
- Benzyl alcohol, *α*-(*α*-isoamylaminoethyl), and -HCl, 4205°.
- Ephedrine, butyl-, 3982°.
- Phenethyl alcohol, *p*-amino-*α*, *α*-dipropyl-, and -HCl, 1892°.
- C₁₄H₂₂NO₂** Butylamine, *γ*-*tert*-methoxyphenyl-, *N*, *N*, *β*-trimethyl-, P 2987°.
- Butyraldehyde, *β*-anilino-, di-Et ester, 4701°.
- Phenethylamine, *α*-(*α*, *α*-diethoxyethyl)-, 1895°.
- 1-Propanol, 3-diethylamino-2-methoxyphenyl-, P 3234°.
- C₁₄H₂₂N₂S** *Δ*²-2-Butenone, 4-(2,2,4,6-trimethyl-*Δ*²-cyclohexenyl)-, thiosemicarbazone, 3692°.
- C₁₄H₂₂P** Phosphine, dibutylphenyl-, and *tert*-butyl-, compd., 2150°.
- Phosphine, diisobutylphenyl-, and *tert*-butyl-, 4442°.
- C₁₄H₂₄** *p*-Menthane, 3-*β*-butenyldene-, 217°.
- C₁₄H₂₂IP** Methylidipropyl *p*-tolylphosphonium iodide, 4442°.
- C₁₄H₂₂N₂O₂** Barbituric acid, 5,5-dimethyl-, 3021°.
- Cyclohexanecarboxylic acid, 2,2-dimethyl-4-cyclohexylcarbonylamino-, and *tert*-butyl-, 2958°.
- C₁₄H₂₂N₂O₂** Cystine, *N*, *N'*-diacetyl-, di-Et ester, 5161°.
- C₁₄H₂₂N₂O₄** 4,4'-Bisemcarbazide, 1,1'-bis(4-benzyloxypropylidene)-, di-Et ester, 5561°.
- C₁₄H₂₂O** Acetaldehyde, dicyclohexyl-, 111°.
- Acetophenone, *α*-cyclohexylhexahydro-, 113°.
- C₁₄H₂₂O₂** Acetic acid, dicyclohexyl-, and *tert*-butyl-, 113°.
- Cyclohexanol, 4-cyclohexyl-, and *tert*-butyl-, 4689°.
- C₁₄H₂₂O₄** 1,1-Cyclopentenediacetic acid, *α*-methyl-, di-Et ester, 119°.
- Spiro[cyclohexane-1,5'-*m*-dioxane]-2-carboxylic acid, 2',4'-dimethyl-, Et ester, 4673°.
- C₁₄H₂₂O₄** Ester, b.p. 140-55°, from ozonide of dihydrozingiberene, 3455°.
- C₁₄H₂₂O₄** Ester, b.p. 140-50°, from ozonide of dihydrozingiberene, 3455°.
- C₁₄H₂₂BrN₂O₄** Leucine, *N*-[*N*-(*α*-bromocaproyl)glycyl]-, 3210°.
- Norleucine, *N*-[*N*-(*α*-bromocaproyl)glycyl]-, 3210°.

- $C_{12}H_{22}NO$ Acetaldehyde, dicyclohexyl-, oxime, 113⁸.
Acetamide, α , α -dicyclohexyl-, 113⁸.
Acetophenone, α -cyclohexylhexahydro-, oxime, 113⁷.
 $C_{12}H_{22}N_2O$ 1-Propanone, 1-2-camphanyl-, semicarbazone, 2433².
 $C_{12}H_{22}N_2O_2$ Malonic acid, (γ -keto- α , α -dimethylbutyl)-, di-Et ester, semicarbazone, 2153¹.
 $C_{12}H_{22}$ Ethane, s -dicyclohexyl-, 113⁸.
 $C_{12}H_{22}Br_2MnN_2O_4 + 4H_2O$, 1363¹.
 $C_{12}H_{22}Br_2N_2NiO_4$, 1363¹.
 $C_{12}H_{22}CdN_4O_{10} + 4H_2O$, 1363¹.
 $C_{12}H_{22}N_2$ Quinoline, decahydriperidyl-, 132¹.
 $C_{12}H_{22}O$ Compd., b_p 140-3°, from α -pinene oxide, 4464¹.
Cyclotetradecanone, 1111¹.
Ethanol, 1,2-dicyclohexyl-, 113⁸.
Isopulegol, butyl-, 128².
 $\Delta^2 \beta$ -3- β -Menthaneethanol, α -ethyl-, 2156¹.
Pulegol, butyl-, 128², 2167².
—, isobutyl-, 2167².
 $C_{12}H_{22}O_2$ Camphorsmol, 3051⁸.
Compd., m. 140-6°, from ethylidenolus phenol, 4690².
Cyclohexanecaprylic acid, P 848.
Myristic acid, ν -hydroxy-, lactone, 1111¹, P 4483².
 γ -Tetradecenic acid, 1109².
 $C_{12}H_{22}O_2$ Sabinaldehyde, acetate, 3664¹.
 $C_{12}H_{22}O_2$ Sabine acid, acetate, 3664¹.
 $C_{12}H_{22}O_2$ Tartaric acid, di-Am ester, 144⁸.
 $C_{12}H_{22}AsO_2$ Dipinaconearsonacetic acid, 596¹.
 $C_{12}H_{22}BrO_2$ Myristic acid, ν -bromo-, 3664¹.
 $C_{12}H_{22}N$ Quinoline, 2,3-diethyldecahydro-1-methyl(?), ferrocyanide, 132².
 $C_{12}H_{22}NO$ Campholamide, N , N -diethyl-, 320⁸.
Myristonitril-, ν -hydroxy-, 3664¹.
 $C_{12}H_{22}NO_2$ Menthylamine, tartrate, 2167².
 $C_{12}H_{22}N_2O_2$ Undecylic acid, α -formyl-, Me ester, semicarbazone, 1388².
 $C_{12}H_{22}N_2O_2$ Leucine, glycylleucyl-, 5199².
Leucine, N -(N -norleucylglycyl)-, 3210².
Norleucine, N -(N -norleucylglycyl)-, 3210².
 $C_{12}H_{22}$ 1-Tetradecene, 3897².
 $C_{12}H_{22}ClNO_2$ 5-Acetyl-2,3,6-trimethylglucosidotrimethylammonium chloride, 1116².
 $C_{12}H_{22}FeN_2O_2$ Addn. compd. of $11Fe(CN)_6$ and C_2H_5OH , 3638².
 $C_{12}H_{22}O$ Myristaldehyde, 4920².
Undecylaldehyde, α , α -, trimethyl-, 4926².
 $C_{12}H_{22}O_2$ (See also *Myristic acid*)
Capric acid, α -ethyl-, Et ester, 2934².
Lauric acid, Et ester, 318².
 $C_{12}H_{22}O_2$ Myristic acid, ν -hydroxy-, 3664¹.
Tridecic acid, μ -hydroxy-, Me ester, 1388¹, 3664¹.
 $C_{12}H_{22}O_2$ Cyclohexane, 1,3-bis(β methoxypropoxy)-, 4677².
 $C_{12}H_{22}O_2$ Glucoside, triethylethyl-, 1118².
2-Octanol, glucoside, 4714¹.
 $C_{12}H_{22}NO$ Cyclohexanecetylamine, 3 isomoxy- N -methyl-, 1131¹.
 $C_{12}H_{22}HgO_2S$ Heptane, 1-(hydroxymercuri)-, sulfate, 1871².
 $C_{12}H_{22}N$ Decylamine, β -ethyl-, N , N dimethyl-, 2934².
 $C_{12}H_{22}IP$ Tributylethylphosphonium iodide, 2150².
 $C_{12}H_{22}N_2$ Guanidine, decamethylenebis[methyl-, P 5197².
 $C_{12}H_{22}N_{10}$ Biguanide, α , α' -decamethylenebis-, $-H_2SO_4$, 4932¹.
 $C_{12}H_5BrClO_2$ Anthraquinone, 1,2,7-trichloro-6-(dibromomethyl)-, 4214².
 $C_{12}H_5ClO_2$ 2-Anthraldehyde, 3,5,6-trichloro-9,10-dihydro-9,10-diketo-, 4214².
 $C_{12}H_5ClO_2$ 2-Anthraquinonecarboxylic acid, 3,5,6-trichloro-, 4214².
 $C_{12}H_5BrClO_2$ Anthraquinonecarboxylic acid, bromochloro-, P 2447².
 $C_{12}H_5BrNO_2S$ 2-Anthraquinonesulfonic acid, bromocyano-, P 2117².
 $C_{12}H_5BrClO$ Anthraquinone, 1,4-dichloro-2-(dibromomethyl)-, 2712².
 $C_{12}H_5ClNO$ Anthraquinonitrile, chloro-, P 7174².
 $C_{12}H_5HgO_2$ Anthraquinonecarboxylic acid, (hydroxymercuri)-, anhydride deriv., 1898².
 $C_{12}H_5BrN_2O_2$ 1-Anthraquinonitrile, 4-amino-3-bromo-, P 851².
 $C_{12}H_5BrO_2$ 2-Anthraquinonecarboxylic acid, 1-bromo-, 1898².
 $C_{12}H_5BrO_2S$ 2-Anthraquinonecarboxylic acid, 1-bromo-3-sulfo-, P 2447².
 $C_{12}H_5BrClO$ Anthraquinone, chloro(dibromomethyl)-, 2712², 4697².
 $C_{12}H_5BrIO$ Anthraquinone, 2-(dibromomethyl)-1-iodo-, 2711².
 $C_{12}H_5BrO$ Anthraquinone, 1-bromo-3-(dibromomethyl)-, 2712².
 $C_{12}H_5ClHgO_2$ 2-Anthraquinonecarboxylic acid, (chloromercuri)-, 1898², 1899².
 $C_{12}H_5ClO_2$ Anthraldehyde, chloro-9,10-dihydro-9,10-diketo-, 4697².
 $C_{12}H_5ClO_2$ Anthraquinonecarboxylic acid, chloro-, P 2447², 4697².
 $C_{12}H_5ClO_2$ Anthraldehyde, 1,5,10-trichloro-, P 2117², P 3933².
 $C_{12}H_5ClO_2$ Anthraquinone, trichloromethyl-, 3464², 4211².
 $C_{12}H_5IO_2$ 2-Anthraquinonecarboxylic acid, 3-iodo-, 1899².
 $C_{12}H_5NO_2S$ 2-Anthraquinonesulfonic acid, cyano-, P 2447².
 $C_{12}H_5BrIO$ Anthraquinone, 2-(bromomethyl)-1-iodo-, 2711².
 $C_{12}H_5BrO_2$ Anthraquinone, 1,3-dibromo-2-methoxy-, 2172².
 $C_{12}H_5BrN_2S$ 5-Benzothiazolenitrile, 1- β -cyanamino-, hexabromide, $-H_2O$, 2973².
 $C_{12}H_5ClNO$ Indone, 5-chloro-2(β tropophenyl)-, 2176².
 $C_{12}H_5ClO_2$ 9-Anthraldehyde, 3,10-dichloro-, 2147², P 3933².
 $C_{12}H_5ClO_2$ Anthraquinone, dichloromethyl-, 2712², P 2990².
 $C_{12}H_5K_2O_3$ Anthraquinone, 1,4-dimercapto-2-methyl-, di-K deriv., 2712².
 $C_{12}H_5NO_2$ 2-Anthraldehyde, 1-amino-9,10-dihydro-9,10-diketo-5-nitro-, P 1142².
 $C_{12}H_5NO_2$ 2-Anthraquinonecarboxylic acid, 1-amino-5-nitro-, P 850².
 $C_{12}H_5N_2O_2$ Cinnamonnitrile, α -(2,4-dinitrophenyl)- β -nitro-, 4684².
 $C_{12}H_5N_2S$ 5-Benzothiazolenitrile, 1- β -cyanamino-, 2973².
 $C_{12}H_5N_2O$ Urea, 3-bis-5-nitro-2-ben(isoxazoly)-, 2973².
 $C_{12}H_5O_2$ 1-Anthrac acid, 9,10-dihydroxy-, γ -lactone, 3701², 4695².
 $C_{12}H_5O_2$ 2,2'-Spiroanthraldehyde, 1896².
 $C_{12}H_5O_2$ 1-Anthraquinonecarboxylic acid, 2-hydroxy-, 2171².

- C₁₅H₈O₆ Munyistin, 1897^a.
 C₁₅H₈O₆S Anthraquinonecarboxylic acid, sulfo-, P 2447^a.
 C₁₅H₈BrO₂ Anthraquinone, 1-bromo-3-methyl-, 2711^a.
 C₁₅H₈BrO₂ Anthraquinone, 1-bromo-2-methoxy-, 2173^a.
 C₁₅H₈ClO 9-Anthraldehyde, 10-chloro-, P 3933^a. 1-Anthroyl chloride, 4696^a.
 C₁₅H₈ClO₂ Anthraquinone, chloromethyl-, 2711^a, 3466^a, 4696^a, 4697^a.
 C₁₅H₈ClO₂ Anthraquinone, chloromethoxy-, P 3104^a.
 C₁₅H₈Cl₂O₂ Benzoic acid, dichloro(4-chloro-*m*-toluyl)-, 3464^a.
 C₁₅H₈IO₂ Anthraquinone, 2-iodo-3-methoxy-, 2173^a.
 C₁₅H₈NO₂ 1-*meso*-Anthrapyrrol-6(2)-one, 3-hydroxy-, 2173^a.
 C₁₅H₈NO₂ Indone, 2-(*p*-nitrophenyl)-, 2167^a.
 C₁₅H₈NO₂ 2-Anthraquinonecarboxylic acid, amino-, P 1141^a, P 4710^a.
 C₁₅H₈N₂O₂S Phthalimide, *N*-*p*-thiocyananilino-, 2245^a.
 C₁₅H₈N₂O₂ Chalcone, trinitro-, 1167^a.
 C₁₅H₈NaO₂S Anthraquinone, 1-mercapto - 3-methyl-, Na deriv., 2711^a.
 C₁₅H₈BrN₂O₂S Benzothiazole, 1-(*N*-acetyl-*p*-bromoanilino)-5-bromo-, 2973^a.
 C₁₅H₈ClNO Oxazole, 2-[*o*(and *m*)-*halorophenyl*]-5-phenyl-, 2716^a.
 C₁₅H₈ClNO₂ Acrylyl chloride, (nitrophenyl)-phenyl-, 2166^a.
 Anthraquinone, aminochloromethoxy-, P 3104^a.
 C₁₅H₈ClN₂O₂ 5 - Pyrazolone, 3 - (chlorophenyl)-1-(*p*-nitrophenyl)-, 3218^a.
 C₁₅H₈Cl₂ Anthracene, 9,10-dichloro-2-methyl-, 1130^a.
 C₁₅H₈Cl₂N₂O₂S Benzothiazole, 1-(*N*-acetyl-*p*-chloroanilino)-6-chloro-, 2973^a.
 C₁₅H₈Cl₂O₂ Benzoic acid, *o*-(4,6-dichloro-*m*-toluyl)-, P 2989^a.
 C₁₅H₈N₂ 2,3-γ-Indoloquinoline, *salts*, 5384^a.
 C₁₅H₈N₂O₂ Acrylonitrile, (nitrophenyl)phenyl-, 2166^a.
 C₁₅H₈N₂O₂ Oxazole, (nitrophenyl)phenyl-, 2716^a; and -HCl, 2716^a.
 C₁₅H₈N₂O₂S 5 - Benzothiazolecarboxylic acid, 1-*p*-carboxyanilino-, 2973^a.
 C₁₅H₈N₂O₂ Chalcone, 4,3'-dinitro-, 1164^a.
 C₁₅H₈N₂O₂S 3-Coumarinsulfonanilide, 6-nitro-, 127^a.
 C₁₅H₈N₂O₂ Benzimidazole, 2-(2,4-dinitrostryl)-, 4683^a.
 C₁₅H₈N₂O₂ Benzophenone, 2,4-dimethyl-3,5',-5',5'-tetranitro-, 4687^a.
 C₁₅H₈NO 9-Anthraldehyde, P 2446^a.
 C₁₅H₈NO₂ Anthroic acid, 4214^a; *Ca salt*, 4696^a.
 C₁₅H₈NO₂ Anthraquinone, hydroxymethyl-, 3466^a, 4696^a, 4697^a.
 1,4-Phenanthrenequinone, methoxy-, 1899^a, 3466^a.
 C₁₅H₈NO₂ Alizarin, 6-methyl-, 2174^a.
 Anthraquinone, 2-methyl-, 2174^a.
 1-Anthroic acid, 9,10-dihydroxy-, 3701^a.
 Rubladin, 128^a.
 Xanthopurpurin, 2-methyl-, 1361^a.
 C₁₅H₈O₂S Thioxanthone, 1,4-dihydroxy-, 4-acetate, 3706^a.
 C₁₅H₈O₂ Anthrapurpurin, 6-methyl-, 3464^a, 4214^a.
 Anthraquinone, trihydroxymethyl-, 3466^a.
 Apigenin, 149^a.
 Benzoic acid, *o*, *o'*-carbonylbis-, 2706^a.
 Flavopurpurin, 7-methyl-(?), 3464^a.
 Genistein, 1883^a, 2181^a.
 Hystazarin, 1-methoxy-, 4697^a.
 Phthalide, 2-(5-methoxy-2-*p*-quinonyl)-, 4682^a.
 Terephthalic acid, 2-benzoyl-, 2706^a.
 C₁₅H₁₀O₂S 1 - Anthraquinonesulfonic acid, 3-methyl-, 2711^a.
 C₁₅H₁₀O₂ (See also *Cyanidin*.)
 Coumarin, 3 - (3,4-dihydroxyphenyl)-5,7-dihydroxy-, 4681^a.
 Flavone, tetrahydroxy-, 2181^a, 4472^a.
 Multiflorinetin, 3230^a.
 C₁₅H₁₀O₂ (See also *Quercetin*.)
 Morin, 2181^a.
 C₁₅H₁₀O₂ Gossypetin, 2181^a.
 Quercetagenin, 2181^a.
 C₁₅H₁₀O₂S₂ 1,4 - Anthraquinonedisulfonic acid, 2-methyl-, 2712^a.
 C₁₅H₁₀BrN₂ Pyrazole, (*p*-bromophenyl)phenyl-, 827^a.
 C₁₅H₁₀Br₂Cl₂NO₂ Alanine, β-[3,5-dibromo-4-(3,5-dichloro-4-hydroxyphenoxy)phenyl]-, 5173^a.
 Alanine, β - [3,5-dichloro-4-(3,5-dibromo-4-hydroxyphenoxy)phenyl]-, 5173^a.
 C₁₅H₁₀Br₂NO₂ Alanine, β-[3,5-dibromo-4-(4-hydroxy-3,5-diiodophenoxy)phenyl]-, 5173^a.
 Alanine, β - [4-(3,5-dibromo-4-hydroxyphenoxy)-3,5-diiodophenyl]-, 5172^a.
 Thyrone, 3',5'-dibromo-3,5-diiodo-, 3691^a.
 C₁₅H₁₀Br₂NO₂ Alanine, β - [3,5-dibromo-4-(3,5-dibromo-4-hydroxyphenoxy)phenyl]-, 5173^a.
 C₁₅H₁₀ClN₂ Pyrazole, (*p*-chlorophenyl)phenyl-, 827^a.
 C₁₅H₁₀ClN₂O 5 - Pyrazolone, 3 - (chlorophenyl)-1-phenyl-, 3218^a.
 C₁₅H₁₀ClN₂O₂ Acrylamide, β-(*p*-chlorophenyl)-α-(*p*-nitrophenyl)-, 2167^a.
 C₁₅H₁₀Cl₂NO₂ Benzoic acid, *o*-(chlorotoluyl)-, 3466^a, 4696^a.
 C₁₅H₁₀ClO₂ Cyanidin chloride, 1645^a.
 C₁₅H₁₀Cl₂NO₂ Alanine, β-[3,5-dichloro-4-(4-hydroxy-3,5-diiodophenoxy)phenyl]-, 5173^a.
 Alanine, β-[4-(3,5-dichloro-4-hydroxyphenoxy)-3,5-diiodophenyl]-, 5172^a.
 C₁₅H₁₀Cl₂O₂ 2,5-Xylenol, 3,4,6-trichloro-, benzoate, 3674^a.
 C₁₅H₁₀Cl₂NO₂ Alanine, β-[3,5-dichloro-4-(3,5-dichloro-4-hydroxyphenoxy)phenyl]-, 5173^a.
 C₁₅H₁₀LN₂O₂ (See also *Thyroxine*.)
 Alanine, β,β-bis(4-hydroxy-3,5-diiodophenyl)-, 3690^a.
 C₁₅H₁₀N Acrylonitrile, α,β-diphenyl-, 2166^a.
 Indeno[1,2-*g*]indole, 5,10-dihydro-, 187^a.
 Quinoline, phenyl-, 392^a, 4743^a.
 C₁₅H₁₀NO α-Tolunitrile, α-benzoyl-, 1126^a.
 C₁₅H₁₀NO₂ Anthraquinone, aminomethyl-, 1273^a, 2711^a.
 Anthraquinone, 1-methylamino-, 1273^a.
 Mandelonitrile, benzoate, 599^a.
 C₁₅H₁₀NO₂S Thiazole, 4-(3,4-dihydroxyphenyl)-2-phenyl-, 3470^a.
 C₁₅H₁₀NO₂ Anthraquinone, 1-(aminomethyl)-2-hydroxy-, 2174^a.
 Phthalimide, *N*-4,2-cresyl-, 1887^a.

- $C_{15}H_{11}NO_4$ Benzoic acid, piperonylideneamino -, 5186⁷.
 Glyoxylic acid, (o - benzamidophenyl) -, 4469⁴.
 $C_{15}H_{11}NO_5$ 6 - Coumarinsulfonanilide, 127¹.
 $C_{15}H_{11}NO_6$ Benzoic acid, o - (3 - nitroanisoyl) -, P 1418⁷.
 $C_{15}H_{11}N_3O_2$ Indole, 1 - methyl - 6 - nitro - 5 - nitroso - 2 - phenyl -, 4700².
 $C_{15}H_{11}N_3O_4$ 1(2) - Phthalazone, 4 - methoxy - 2 - (nitrophenyl) -, 145⁷, 146².
 $C_{15}H_{11}N_3O_7$ Benzophenone, 2,4 - dimethyl - 3,3',5 - trinitro -, 4687⁷.
 $C_{15}H_{11}N_3S$ Thiazole, 4 - phenyl - 2 - phenylazo -, 1410².
 $C_{15}H_{11}N_3O_8$ 1,3,4 - Thiodiazole - 2,5 - dione, 3,4 - dihydro - 3 - phenyl -, 5 - azine with o - nitrobenzaldehyde, 4398².
 $C_{15}H_{11}N_3S$ Thiodiazinindole, 3 - β - phenyl - hydrazino -, 140².
 $C_{15}H_{11}$ Anthracene, 2 - methyl -, 1130².
 Indene, phenyl -, 4213⁴.
 $C_{15}H_{12}BrNO$ Acrylophenone, β - anilino - p - bromo -, 827¹.
 $C_{15}H_{12}BrN_2O_2$ 1,2 - Propanedione, 1 - phenyl -, 1 - [(2 - bromo - 4 - nitrophenyl)hydrazo-], 3680².
 $C_{15}H_{12}Br_2$ Indan, dibromo-1-phenyl -, 4213⁴.
 $C_{15}H_{12}Br_2N_2OS$ Benzothiazole, 1 - (N - acetyl-anilino) -, dibromide, - *H Br*, 2973².
 $C_{15}H_{12}Br_2N_2OS$ Benzothiazole, 5 - methoxy - 1 - p - methoxyanilino -, dibromo deriv -, 2973².
 $C_{15}H_{12}Br_2O_2$ Guaiacol, bromo-, carbonate, 5471².
 $C_{15}H_{12}Br_2N_2OS$ Benzothiazole, 1 - (N - acetyl-anilino) -, hexabromide, 2973².
 $C_{15}H_{12}ClNO$ Acrylophenone, β - anilino - p - chloro -, 827¹.
 $C_{15}H_{12}ClNO_2$ Acridine, 5 - chloro - 2,8 - dimethoxy -, 1904².
 $C_{15}H_{12}ClNO_4$ Benzoic acid, *m* - (5 - chlorovanil-lalamino) -, 4456⁴.
 $C_{15}H_{12}Cl_2O_2$ Xylenol, dichloro-, benzoate, 116², 117¹.
 $C_{15}H_{12}Cl_2NO$ 2,5 - Benzoxylide, 3',4',6'-tri-chloro-, 3674².
 $C_{15}H_{12}INO_2$ Stilbene, 4 - iodo - 4' - methoxy - 2 - nitro -, 2170².
 $C_{15}H_{12}MoN_2OS_2$, 2899⁴.
 $C_{15}H_{12}N_2Na_2O_2$ Benzil, *m* - methyl -, dioxime, Na deriv., 2700⁴.
 $C_{15}H_{12}N_2O$ Furazan, 3 - phenyl - 4 - tolyl -, 2709^{4,2,2}.
 $C_{15}H_{12}N_2O_2$ Anthraquinone, 1,4 - diamino - 2 - methyl -, 2712².
 Furozan, phenyltolyl -, 2709^{4,2,2}.
 Malonimide, N - [p - (p - aminophenyl)-phenyl] -, sulfide, 3456².
 1,3,4,6 - Oxidiazin - 5(4) - one, 2,4 - di-phenyl -, 145².
 $C_{15}H_{12}N_2O_2$ Acrylamide, (nitrophenyl)phenyl -, 2166².
 Acrylophenone, β - anilino - *m* - nitro -, 827¹.
 $C_{15}H_{12}N_2O_2$ Mandelamide, N - (nitrobenzal) -, 2710².
 Salicylic acid, 5 - phenylazo -, acetate, 3913².
 $C_{15}H_{12}N_2O_2$ dimethyldinitro -, 4687⁷.
 $C_{15}H_{12}N_2O_8$ 1,3,4 - Thiodiazole - 2,5 - dione, 3,4 - dihydro - 3 - phenyl -, 5 - azine with benzaldehyde, 1398².
- $C_{15}H_{12}N_2O_8$ Compd., *m*. 200², from o - C_6H_4 -(COCl)₂ and α - phenylthiocarbohydra-zide, 1398².
 $C_{15}H_{12}N_2O_4$ Acetanilide, p - (2,4 - dinitrobenzal-amino) -, 4682².
 $C_{15}H_{12}N_2O_8$ Benzothiazole, 1 - ethyl-, picrate, 142².
 1,2 - Dimethylbenzothiazolium picrate, 142².
 $C_{15}H_{12}N_2O_8$ Benzothiazole, 5 - methoxy - 1 - methyl -, picrate, 390².
 $C_{15}H_{12}N_2O_{10}$ 2(1) - s - Triazone, tetrahydro - 4 - imino - 6 - (nitrophenyl) -, picrate, 4220^{2,2,2}.
 $C_{15}H_{12}N_4S$ 1,2,3,4 - Tetrazole, 5,5' - methylene-ditriazibis[1 - phenyl-, 4470².
 1,2,3,4 - Tetrazol - 5(4) - one, 1,1' - methyl-cuebis[4 - phenyl - 5 - thio -, 4470².
 $C_{15}H_{12}O$ Anthrone, 3 - methyl -, 5183².
 Ether, methyl 1 - phenanthryl, 4468².
 1 - Indanone, 4 - phenyl -, 2710².
 $C_{15}H_{12}O_2$ 9 - Anthroic acid, 9,10 - dihydro -, 4214².
 Propanedione, 1,3 - diphenyl -, 1339², 1877², 2705², 3683², 4215¹, 4683².
 $C_{15}H_{12}O_2S$ Thioxanthone, methoxymethyl-, and salt, 3706².
 $C_{15}H_{12}O_2$ Benzal, p - methoxy-, 4687².
 Benzoic acid, p - (o - tolyl) -, 3915¹.
 Chalcone, dihydroxy-, 836², - *HCl*, 3687².
 Pyruvic acid, diphenyl-, 1617¹.
 $C_{15}H_{12}O_2S$ 1 - Phenanthrenesulfonic acid, Me ester, 4468².
 Thioxanthone, dimethoxy -, and salt, 3706^{2,2}, chlorostannate, 4472².
 $C_{15}H_{12}O_3$ Anthrone, 1,4,6 - trihydroxy - 7 - methyl -, 3464².
 Chalcone, 2',4',6'-trihydroxy-, 836².
 Compd., *m*. 88², from chlorocodizone, 1644².
 Compd., *m*. 159², from chlorocodizone, 1644².
 6 - Dibenzopyrone, 2,9 - dimethoxy-, 4469².
 Flavanone, 5,7 - dihydroxy-, 836², 2162².
 Hydrangenol, 2714¹.
 Isohydrangenol, 2711¹.
 Naphthalenediglyoxylic acid, acetyl, Me ester, 1809², 3466².
 Paracemic acid, 2 - (1 - naphthyl) -, 137¹.
 $C_{15}H_{12}O_4$ Butein, 1883².
 Malonic acid, (naphthoylmethyl) -, 3703².
 Naringenin, 148², 2161², 2956².
 Phthalide, 2 - (2,5 - dihydroxy - p - anisyl) -, 4682².
 $C_{15}H_{12}O_5$ Thioxanthone, dimethoxy -, S - di-oxide, 1901².
 $C_{15}H_{12}O_6$ Benzoic acid, 3 - methoxy - 4,4' - oxybis-, 4475².
 Carthamidin, 3471¹.
 Eriodictyol, 4210².
 Isocarthamidin, 3471¹.
 $C_{15}H_{12}AsN_2O_2$ Benzearsonic acid, p - (5 - amino - 8 - quinolylazo) -, 839².
 $C_{15}H_{12}AuClN_2O_2$ 5 - Acetyl - 4,10 - dihydro - 10 - methyl - 4 - ketophenazonium chloro-sulfate, 2717².
 $C_{15}H_{12}BrO_2$ Resorcylic acid, bromophenethyl-, P 1217².
 $C_{15}H_{12}BrNO_2$ Alanine, β - [3,5 - dibromo - 4 - (p - hydroxyphenoxy)phenyl] -, 5173¹.
 $C_{15}H_{12}Br_2N_2O_2$ Aniline, 2 - (α , β - dibromophen-ethyl) - N - methyl - 5 - nitro - 4 - nitroso-, - *H Br*, 4700².
 $C_{15}H_{12}ClN_2O_2$ Hydrazine, β - benzoyl - α - chloroacetyl - α - phenyl -, 145².

- C₁₅H₁₃ClO₂ 3, 4 - Xylenol, 2 - chloro -, benzoate, 116⁹.
- C₁₅H₁₃ClO₂ Lactic acid, β - chloro - β , β - diphenyl-, 1616⁹.
- C₁₅H₁₃Cl₂NO₂ p - Benzophenetide, 2', 6' - dichloro-, 3910⁹.
- C₁₅H₁₃Cl₂NO₂ Alanine, β - [3, 5 - dichloro - 4 - (p - hydroxyphenoxo)phenyl], 5173².
- C₁₅H₁₃NO Carbazolealdehyde, 9-ethyl-, P 2447¹.
- C₁₅H₁₃NO₂ Thianthrene, 2 - acetamido - 7 - methyl -, 3468⁴.
- C₁₅H₁₃NO₂ Acridine, dimethoxy-, P 3543⁴.
Benzil, methyl-, oxime, 2709^{1,2,4,5,7,8}.
Phthalimidine, 2 - m - anisyl -, 146².
1, 2 - Propanedione, 1, 3 - diphenyl -, 1 - oxime, 4699⁴.
Stilbene, methylnitro-, 2708⁹, 2709^{2,4,5,7,8}.
- C₁₅H₁₃NO₂ 5(10) - Acridone, 2, 8 - dimethoxy-, 1904².
Benzophenone, dimethylnitro-, 4687^{6,7}.
- C₁₅H₁₃NO₂ Anthraquinone, 1, 2, 3, 4 - tetrahydro - 6 - methyl - 5 - nitro -, P 2189⁹, P 5194⁸.
Benzanilide, o' - hydroxy-, methylcarbonate, 4940⁸.
Benzoic acid, 4' - methyl - 2, 3' - iminobis -, 839⁸.
Ethylene oxide, α - p - anisyl - β - (p - nitrophenyl)-, 3919³.
Flavanone, 5, 7 - dihydroxy -, oxime, 836⁹.
- C₁₅H₁₃N₃ 1, 3, 4 - Triazole, 2 - methyl - 1, 5 - diphenyl -, 836³.
- C₁₅H₁₃N₃O₂ 1, 2, 4 - Benzotriazine - 3 - mercaptan, 1, 4 - dihydro - 1 - phenyl -, Ac deriv., 1398³.
- C₁₅H₁₃N₃O₂ Aniline, N - methyl - 5 - nitro - N - nitroso - 2 - styryl -, 4700¹.
- C₁₅H₁₃N₃O₂ Acetanilide, N - methyl-2, 6-dinitro-4-phenyl -, 830⁹.
- C₁₅H₁₃N₃O₂ Benzimidazole, 1-ethyl-, picrate, 1638⁹.
- C₁₅H₁₃N₃S Urea, α - phenyl - β - (1 - phenyl - 5-1, 2, 4-triazolyl)thio-, 1640².
- C₁₅H₁₃N₃S 1, 2, 4 - Triazole - 5 - mercaptan, 1 - phenyl - 3 - (β - phenylthiocarbamido)-, 2178¹.
- C₁₅H₁₃I Indan, 1 - phenyl -, 4213⁸.
Propene, diphenyl -, 2703¹, 3908¹.
- C₁₅H₁₃BrNO Propionamide, α - bromo- - N , N - diphenyl -, 1113¹.
- C₁₅H₁₃BrNO Benzyl alcohol, p - bromo - α - methyl-, carbanilate, 2157⁹.
- C₁₅H₁₃ClNO₂ Toluidine, N - (5 - chlorovanilla) -, 4456⁹.
- C₁₅H₁₃ClNO₂ p - Anisidine, N - (5 - chlorovanilla)-, 4456⁹.
- C₁₅H₁₃NO₂S Thianthrene, 2 - acetamido - 7 - methyl -, quinoid sulfate, 3468⁴.
- C₁₅H₁₃N₂O₂ Acridine, 5 - amino - 2, 8 - dimethoxy-, and -HCl, 1904⁴.
Aniline, N - methyl - 5 - nitro - 2 - styryl -, 4700¹.
Benzil, methyl-, dioxime, 2709^{1,3,4,5,7,8}.
Phenazine, 1 - methoxyacetyldihydro -, 2717⁹.
1 - Phenazinol, 10 - acetyl - 5, 10 - dihydro - 5 - methyl -, 2717⁹.
1, 2, - Propanedione, 1, 3 - diphenyl -, di-oxime, 4699⁴.
- C₁₅H₁₃N₂O₂ Benzoic acid, o - (p - anisylazo) -, Me ester, 4679⁸.
Benzoic acid, 2 - methoxy - 5 - phenylazo -, Me ester, 4203⁷.
Salicylic acid, 5 - phenylazo -, Et ester, 4203⁷.
- C₁₅H₁₃N₂O₂ Anthranilic acid, N - (5 - nitro - o - tolyl) -, Me ester, 1131⁸.
- C₁₅H₁₃N₂O₂S [1(2), 2' - Bibenzisulfonazole], 1', 2'-dihydro-2'-methyl-, 4680⁹.
- C₁₅H₁₃N₂O₂ 3 - Hydantoinacetic acid, 5 - piperonylidene-, Et ester, 820⁹.
- C₁₅H₁₃N₂S Benzylamine, N - methyl - N - p - thiocyanophenyl-, 2245⁴.
- C₁₅H₁₃N₂O Carbanilide, bis(methyleneamino) -, 2158¹.
Hydrazomethylene, 1 - phenylazo - 2 - vic - m - xylyl - 1, 3 - endoxy -, 4939⁸.
—, 1- o -tolylazo-2- o -tolyl-3-endoxy-, 4939⁸.
—, 1- vic - m -xylylazo-2- p -phenyl-1, 3-endoxy -, 4939⁸.
Tetrazole, phenyl- vic - m -xylyl-3, 5-endoxy -, 4939⁸.
—, 1 - o - tolyl - 4⁶ - o - tolyl - 3, 5 - endoxy -, 4939⁸.
- C₁₅H₁₃N₂S Carbanilide, bis(methyleneamino)-thio-, 2157⁹.
1, 3, 4, 6 - Thiodiazine, 5 - phenyl - 2 - β - phenylhydrazino-, 140⁸.
1, 2, 4 - Triazol - 3(2) - one, benzyl - 4, 5 - dihydro - 5 - imino - 4 - phenylthio -, 1639⁹.
- C₁₅H₁₃N₂S 3 - Triazole, 3 - anilino - 5 - (β - phenylthiocarbamido)-, 2177⁹.
1, 2, 4 - Triazole, 3(or 5) - amino - 1 - phenyl - 5(or 3) - (β - phenylthiocarbamido) -, 2177⁹.
- C₁₅H₁₃O Benzophenone, 2, 4 - dimethyl -, 4687².
Ether, benzohydril methyl, 3920¹.
9 - Fluorencethanol, 2713⁸.
2 - Indanol, 2 - phenyl -, 4213⁸.
1 - α - Naphthindanone, 3, 5 - dimethyl -, P 1416².
Phenol, p - 1 - indanyl -, 1130².
2 - Propanone, 1, 3 - diphenyl -, 2171⁴, 5175⁹.
Stilbene, p - methoxy -, 2179⁹.
- C₁₅H₁₃O₂ 9 - Anthroic acid, 1, 2, 3, 4 - tetrahydro -, 4214⁸.
Benzophenone, methoxymethyl-, 130⁹.
Hydrocinnamic acid, o - phenyl -, 2710⁴.
2 - Propanone, 1 - phenoxy - 3 - phenyl -, 4480⁹.
Propiophenone, hydroxyphenyl-, 125⁸.
 α -Toluic acid, tolyl ester, 5178¹.
3, 5 - Xylenol, benzoate, 1122¹.
- C₁₅H₁₃O₂ Acetophenone, α - (m - anisyl-oxo) -, 4702¹.
Acetophenone, 4 - hydroxy - 2 - methoxy - α -phenyl-, 2180⁹.
Benzoin, methoxy-, 4687^{2,8}.
Carbonic acid, ditolyl ester, 2430⁷, 2956⁷.
phenethyl phenyl ester, 1872¹.
Propiophenone, 2, 4 - dihydroxy - β - phenyl -, 836⁸.
Salicylic acid, phenethyl-, P 5012⁹.
- C₁₅H₁₃O₂S Benzoic acid, o -(6 - methyl - m - anisylmercapto)-, 3706².
- C₁₅H₁₃O₂ Benzophenone, 4 - hydroxy - 2, 6 - dimethoxy -, 830⁸.
6 - Dibenzopyrone, 7, 8, 9, 10 - tetrahydro - 3 - hydroxy -, acetate, 383⁸.
Phloropropiophenone, β -phenyl-, 837¹.
- C₁₅H₁₃O₂S Benzoic acid, o - (3, 4 - dimethoxy-phenylmercapto)-, 3706².
- C₁₅H₁₃O₂ Guaiacol, carbonate, 5471⁸.
Phloretin, 1883², 2162¹.
- C₁₅H₁₃O₂ See *Catechol*.
- C₁₅H₁₃O₂S Benzoic acid, o - (2, 5 - dimethoxy-phenylsulfonyl)-, 1901⁴.

- $C_{15}H_{15}O_2S_2$ 2 - Thianthresol, 3, 6, 7 - trimethoxy-, sulfone, sulfoxide, 3467⁸.
- $C_{15}H_{15}Br$ Propane, 1 - bromo - 2, 3 - diphenyl -, 2709⁹.
- $C_{15}H_{15}BrN_2S$ Carbanilide, 2 - bromo - 2', 4 - dimethylthio-, 3445⁷.
- $C_{15}H_{15}BrN_2O_2$ Δ^2 - Cyclopentene, 2 - hydroxy - 4, 4, 5, 5 - tetramethyl - 3 - (2, 4, 6 - tribromophenylazo)-, 109⁸.
- $C_{15}H_{15}ClN_2O$ Cinchoninic acid, 2 - chloro -, piperidide, P 1217⁵.
- $C_{15}H_{15}ClN_2O_2$ 9 - Carbazolecarboxylic acid, 6 - chloro - 1, 2, 3, 4 - tetrahydronitro -, Et ester, 1397⁷.
- $C_{15}H_{15}ClO_2$ Methane, di - *p* - anisylchloro -, 3920¹.
- $C_{15}H_{15}ClO_4$ Umbelliferone, 3 - (chloropropyl) - 4 - methyl -, acetate, 2959⁷.
- $C_{15}H_{15}Cl_2N$ Dibenzylamine, *p*, *p'* - dichloro - *N* - methyl-, 4450⁸.
- $C_{15}H_{15}Cl_2NO_2S_2$ *m* - Benzenedisulfonyl chloride, 5 - nitro -, compd with mesitylene, 2428².
- $C_{15}H_{15}CoN_2O_4$ Compd. of $Co(NO_2)_2$ and pyridine, 3180¹.
- $C_{15}H_{15}IN_7$ Benzylmethylbenzimidazolium iodide, 1637⁹.
- $C_{15}H_{15}N$ 1 - Indanamine, 2 - phenyl -, 4213⁷.
- $C_{15}H_{15}NO$ Acetamide, *N* - *o* - phenylbenzyl -, 2710⁹.
- Benzophenone, aminodimethyl -, 4657⁸.
- Benzylamine, *N* - anisal -, 4461⁷.
- , *N* - benzal - *p* - methoxy -, 4461².
- 2 - Propanone, 1 - amino - 1, 3 - diphenyl -, 1895⁷.
- $C_{15}H_{15}NO_2$ Alanine, β , β - diphenyl -, 3691¹.
- Benzyl alcohol, (ammonomethyl) -, benzoate, 3051⁴.
- Levulinamide, *N* - naphthyl - (?), 4193⁷.
- Valeric acid, γ -hydroxy - naphthylamine, γ -lactone (?), 4193¹.
- $C_{15}H_{15}NO_2S$ Isoindoline, 2 - *p* - tolylsulfonyl -, 2176².
- $C_{15}H_{15}NO_3$ Benzoin, methoxy-, oxime, 4687².
- Everminanilide, 4478¹.
- $C_{15}H_{15}NO_4$ Alanine, β , β -bis (*p*-hydroxyphenyl) -, 3009⁹.
- Indole, 1 - acetyl - 3 - glycolyl - 2 - methyl -, acetate, 3928².
- $C_{15}H_{15}NO_5$ Valeric acid, α - acetyl - δ - phthalimido -, 834⁷.
- $C_{15}H_{15}NO_6$ 1 - Indolinemalonic acid, 2, 3 - diketone, di-Et ester, 2970⁹.
- $C_{15}H_{15}N_2O$ (See also *Ritanol*.)
- Anthracenone, dihydro -, semicarbazone, 4604⁸.
- Formanilide, (2, 6 - xylylazo) -, 4939⁸.
- Phenanthrone, dihydro -, semicarbazone, 3703⁸.
- $C_{15}H_{15}N_2O_2$ Cinnamic acid, α - amino - β - hydroxy-, phenylhydrazide, 3914².
- Methyl red, 576¹, 3541⁸.
- β - Phenylenediamine, *N*, *N*, - dimethyl - *N'* - *p* - nitrobenzal -, 3919⁸.
- $C_{15}H_{15}N_2S$ Thionine, trimethyl -, 4241², 4213¹.
- $C_{15}H_{15}N_2O_2S$ Benzaldehyde, *p* - nitro-, thio - 4 - *m* - toluinosemicarbazone, 140⁴.
- $C_{15}H_{15}N_2O_3$ Alaninanilide, picrate, 1112⁹.
- $C_{15}H_{15}N_2O_4$ Benzylamine, *N*, *N* - dimethyl-nitro -, picrate, 2428¹.
- $C_{15}H_{15}BrHgN$ Benzylamine, *N* - [*p* - (bromomercuri)phenyl] - *N* - ethyl -, 1889¹.
- $C_{15}H_{15}ClHgN$ Benzylamine, *N* - [*p* - (chloromercuri)phenyl] - *N* - ethyl -, 1889¹.
- $C_{15}H_{15}ClNO_2$ 1 - Butanol, 4 - chloro -, 1 - naphthalenecarbamate, 2422⁹.
- 9 - Carbazolecarboxylic acid, 6 - chloro - 1, 2, 3, 4 - tetrahydro -, Et ester, 1397⁷.
- 1 - Naphthalenecarbamate, δ - chlorobutyl ester, 4444⁹.
- $C_{15}H_{15}ClN_2Rh$, 4217².
- $C_{15}H_{15}HgIN$ Benzylamine, *N* - ethyl - *N* - [*p* - (iodomercuri)phenyl] -, 1889¹.
- $C_{15}H_{15}N_2$ α - Toluamidine, *N* - benzyl -, 1895⁸.
- $C_{15}H_{15}N_2O$ Acetanilide, *p* - benzylamino -, 3781¹.
- Benzanilide, *p'* - dimethylamino -, 3791¹.
- Propionamide, α - amino - *N*, *N* - diphenyl -, 1113¹.
- $C_{15}H_{15}N_2OS$ Carbanilide, 4 - hydroxy - 2, 2' - dimethylthio -, 3445⁷.
- Carbanilide, methoxymethylthio-, 3445⁷.
- $C_{15}H_{15}N_2O_2$ 3 - Indazolecarboxylic acid, 2 - benzyl - 4, 5, 6, 7 - tetrahydro -, 2971⁹.
- 3 - Indazolecarboxylic acid, 4, 5, 6, 7 - tetrahydromethyl - 2 - phenyl -, 2972⁵.
- 3 - Isoindazolecarboxylic acid, 1 - benzyl - 1, 5, 6, 7 - tetrahydro -, 2971⁹.
- , 4, 5, 6, 7 - tetrahydromethyl - 1 - phenyl -, 2972⁵.
- $C_{15}H_{15}N_2O_2S$ Urea, α - phenylthio - β - vanillyl -, 3452³.
- $C_{15}H_{15}N_2O_3$ Carbazole, 9 - acetyl - 1, 2, 3, 4 - tetrahydro - 3 - methylnitro -, 139⁷.
- Urea, α - phenyl - β - vanillyl -, 3152⁹.
- $C_{15}H_{15}N_2S$ Carbanilide, dimethylthio-, 1115⁷, 3445⁸.
- Pseudourea, α , γ - dimethyl - α , β - diphenylthio-, 1115².
- $C_{15}H_{15}N_2O_2$ Benzaldehyde, *p* - dimethylamino -, *p* - nitrophenylhydrazide, 2429⁹.
- $C_{15}H_{15}N_2O_4$ Caffeine, α 1 - benzyloxy -, P 612².
- $C_{15}H_{15}N_2O_5$ Caffeine - salicylic acid, *Na* salt, 3049⁹.
- $C_{15}H_{15}N_2O_7$ Indole, 4, 5, 6, 7 - tetrahydro - 2 - methyl-, picrate, 1635⁴.
- $C_{15}H_{15}O$ Anisole, benzylmethyl-, 131¹.
- Benzohydrol, *o*, *p'* - dimethyl -, 5182⁹.
- , α - ethyl -, 4465¹.
- Propanol, diphenyl -, 2171¹, 2709⁹.
- $C_{15}H_{15}O_2$ Benzophenone, di - Me acetal, 2171¹.
- Benzyl alcohol, α - methyl - α - phenoxy-methyl-, 4682⁷.
- Ethanol, 1 - *p*, *o*-arysyl - 2 - phenyl -, 2179⁹.
- α , γ , ϵ - Heptatrienic acid, δ - phenyl -, Et ester, 3688⁹.
- Methane, phenethyloxyphenoxy-, 1871⁸.
- $C_{15}H_{15}O_2$ 6 - Dibenzopyrone, 7, 8, 9 - tetrahydro - 3 - hydroxy - 1, 9 - dimethyl -, 383⁸.
- 1 - Naphthoic acid, 4 - butoxy -, P 2190⁹.
- $C_{15}H_{15}O_4$ Coumarin, 3 - acetyl - 6, 8 - diethyl - 5 - hydroxy -, 3219⁸.
- $C_{15}H_{15}O_5$ Methysticin, dihydro-, 2965².
- Methysticin acid, dihydro -, 2965⁷.
- γ - Pentenic acid, α - acetyl - δ - (*m* - hydroxyphenyl) - β - keto -, Et ester, 4211¹.
- $C_{15}H_{15}O_5S_2$ *m* - Cresol, 2, 4, 6 - trimercaptol -, tetraacetate, 825⁹.
- $C_{15}H_{15}O_6S_2$ Methionie acid, dimethyl-, di-Pth ester, 94⁸.
- $C_{15}H_{15}O_6$ Daphnin, 2718².
- $C_{15}H_{17}As_2N_3O_2$ Benzenearsonic acid, 4 - anilino - 3 - isopropylideneamino - (?), 2954⁷.
- 5 - Benzimidazolecarboxylic acid, 2, 3 - dihydro - 2, 2 - dimethyl - 1 - phenyl - (?), 2954³.
- $C_{15}H_{17}As_2N_3O_2$ Propionamide, β - [*p* - (3 - am-

- ino - 4 - hydroxyphenylarseno)anilino] -, and di - HCl, 5471³.
- C₁₅H₁₇As₂N₃O₄S Arsenobenzene - 4' - glycine - amide - N - methylenesulfoxylic acid, 3 - amino - 4 - hydroxy -, 119⁴.
- C₁₅H₁₇Br₂N₂ Isopyrrole, 4 - bromo - 2 - [(4 - bromo - 3 - ethyl - 5 - methyl - 2 - pyrrol - methylene) - 5 - (bromomethyl) - 3 - ethyl -, - HBr, 2184⁴.
- C₁₅H₁₇ClN₃O₂ 9 - Carbazolecarboxylic acid, 6 - chloro - 1, 2, 3, 4, 4a, 9a - hexahydro - 9a - hydroxy - 4a - nitro -, Et ester, 139⁷.
- C₁₅H₁₇N 2 - Naphthylamine, N - α - methyl - Δ¹ - butenyl -, P 3052⁷.
- C₁₅H₁₇NO Carbazole, 9 - acetyl - 1, 2, 3, 4 - tetrahydro - 3 - methyl -, 139⁷.
- Ethanol, 2 - methylamino - 1, 2 - diphenyl -, and - HCl, 4462^{1, 4}.
- α, γ, ε - Heptatrienaldehyde, δ - (p - dimethylaminophenyl) -, 381³.
- 2 - Propanol, 1 - amino - 1, 2 - diphenyl -, 4693³.
- C₁₅H₁₇NO₂ Benzohydrol, p - dimethylamino - p' - hydroxy -, 384¹.
- 1 - Naphthamide, 2 (and 4) - butoxy -, P 2190¹.
- Phenethylamine, benzoate, 1895⁴.
- Spiro[cyclopentane - 1, 2' - pseudoindoxyl], 1' - acetyl - 3 - methyl -, 139⁷.
- Spiro[cyclopentane - 1, 3' - pyrrolidine] - 5' - one, 1' - benzoyl -, 819⁷.
- C₁₅H₁₇NO₂ Benzylamine, p - methoxy -, benzoate, 4461³.
- C₁₅H₁₇NO₂ 3 - Indoleacetic acid, 2 - carboxy -, di - Et ester, 834⁴.
- C₁₅H₁₇N₂ Guanidine, dimethyldiphenyl -, P 847⁹.
- Guanidine, di - o - tolyl -, P 3715⁴; salts, P 5197².
- C₁₅H₁₇N₂O₂S Benzenesulfonamide, p-formyl - N, N - dimethyl -, phenylhydrazine, 4680⁴.
- Thiazole, 2 - amino - 5 - (aminotolyl) - 4 - methyl -, diacetyl deriv., 1410^{4, 4}.
- C₁₅H₁₇N₂O₂S Benzenesulfonyl acid, p - (p - dimethylaminophenylazo) -, Me ester, 4201⁴.
- C₁₅H₁₇N₂O₂ Barbituric acid, 5, 5 - diethyl - 1 - p - nitrobenzyl -, 821³.
- Δ² - 3, 4 - Pyrazolinedicarboxylic acid, 4 - methyl -, 1 - phenylcarbamyl -, di - Me ester, 3705¹.
- C₁₅H₁₇N₂O₂S Piperonyl alcohol, α - anilino -, acid sulfite guanidine salt, 5171⁴.
- C₁₅H₁₇As₂N₃O₄S Arsenobenzene - N - methylenesulfoxylic acid, 4 - amino - 4' - β - hydroxyethylamino -, 119⁴.
- C₁₅H₁₇As₂N₃O₄S Arsenobenzene - N - methylenesulfoxylic acid, 3 - amino - 4 - hydroxy - 4' - β - hydroxyethylamino -, 119⁴.
- C₁₅H₁₇Br₂N₂O₂ Glycine, N - [N - (α - bromohydrocinnamyl)glycyl]glycyl] -, 2092².
- C₁₅H₁₇ClNO₂ Codinal, chlorodihydro-, and perchlorate, 2079⁹.
- C₁₅H₁₇ClNO₂ 9 - Carbazolecarboxylic acid, 6 - chloro - 1, 2, 3, 4, 4a, 9a - hexahydro - 4a, 9a - dihydroxy -, Et ester, 139⁷.
- C₁₅H₁₇ClN₂O₂ Alanine, N - [N - (N - chloroacetyl)glycyl]glycyl] - β - phenyl -, 2092².
- C₁₅H₁₇ClN₂O₂ Bihypnal, 1411¹.
- C₁₅H₁₇N₂ Cinoline, 1, 4, 5, 6, 7, 8 - hexahydro - 3 - methyl - 1 - phenyl -, 2710⁴.
- Indazole, 2 - benzyl - 4, 5, 6, 7 - tetrahydro - methyl -, 2072^{3, 4}.
- Isindazole, 1 - Benzyl - 4, 5, 6, 7 - tetrahydro - methyl -, 2072^{3, 4}.
- C₁₅H₁₇N₂O₂ Benzohydrol, p - amino - p' - dimethylamino -, 384¹.
- C₁₅H₁₇N₂O₂ Cinchoninamide, N, N - diethyl - 2 - methoxy -, P 1217⁹.
- 2 - Naphtioic acid, 6 - (δ - aminobutylamino) -, P 2723².
- 3 - Pyrrolepropionic acid, 5 - (3, 5 - dimethyl - 2 - isopropylidenemethyl) - 4 - methyl -, - HBr, 5192¹.
- C₁₅H₁₇N₂O₂S 2 - Oxazolidone, 3 - (allylthiocarbonyl) - 5 - (benzylmercaptomethyl) -, 2177⁴.
- C₁₅H₁₇N₂O₂ Barbituric acid, 1 - benzyl - 5, 5 - diethyl -, 821³.
- Barbituric acid, 5, 5 - diethyl - 1 - p - tolyl -, 3024¹.
- , 5 - ethyl - 1 - phenyl - 5 - propyl -, 3024 - Δ² - 4 - Pyrazolinepropionic acid, δ - keto - 3 - methyl - 1 - phenyl -, Et ester, 101¹.
- C₁₅H₁₇N₂O₂ Barbituric acid, 1 - p - anisyl - 5, 5 - diethyl -, 3024¹.
- 4 - Piperidone, 2, 2, 6 - trimethyl - 1 - nitrobenzoyl -, 2935⁴.
- C₁₅H₁₇N₂ Guanidine, (p - dimethylaminophenyl)phenyl -, P 5475⁴.
- C₁₅H₁₇N₂O₂S Piperonyl alcohol, α - anilino acid sulfite, guanidine salt, 5171⁴.
- C₁₅H₁₇N₂O₂ Indole, 2, 3, 4, 5, 6, 7 - hexahydro - 2 - methyl -, picrate, 1635⁴.
- Pyrrole, 3, 4 - diethyl - 2 - methyl -, picrate, 2184⁴.
- C₁₅H₁₇N₂S Urea, α - allyl - β - [5 - (allylamino) - 1 - phenyl - 3 - 1, 2, 4 - triazoly]thio -, 1840².
- C₁₅H₁₇O Compd., b₁₅ 156-8°, from cinnamaldehyde and 2 - methyl - 1, 3 - pentadiene, 3692².
- C₁₅H₁₇O₂ Δ² - 2, 4 - Hexenedione, 6 - p - cumenyl -, 4211⁴.
- C₁₅H₁₇O₂ (See also Santonin.)
- α, γ - Pentadienic acid, δ - p - anisyl -, Et ester, 3912².
- C₁₅H₁₇O₂ Malonic acid, (α - acetylbenzyl) - mono-Et ester, 3210⁹.
- C₁₅H₁₇ClN₂O Trimethyl[(and 2) - naphthylcarbamylmethyl]ammonium chloride, 3024¹.
- C₁₅H₁₇ClN₂O₂ Alanine, N - (N - β - chlorobutyryl)glycyl] - β - phenyl -, 2726⁷.
- Leucine, N - (N - chlorobenzoyl)glycyl] -, 1389⁷.
- C₁₅H₁₇N Quinoline, 6 - cyclohexenyltetrahydro-, and - HCl, 4688¹.
- C₁₅H₁₇NO Acetanilide, p - Δ¹ - cyclohexenyl - methyl -, 4688¹.
- Acetanilide, p - methylcyclohexenyl -, 4688¹.
- Carbazole, 9 - acetylhexahydro - 3 - methyl -, 139⁷.
- Compd., m. -6°, from o - cresol and dimethylamine, 122⁹.
- Δ¹ - Cycloheptenacetanilide, 4678⁹.
- Cycloheptindole, 10 - acetyl-4b, 5, 6, 7, 8, 9, 9a - 10-octahydro-, 138⁹.
- C₁₅H₁₇NO₂ See Tropacocaine.
- C₁₅H₁₇NO₂ 4a, 9a - Carbazolodiol, 9 - acetyl - 1, 2, 3, 4 - tetrahydro - 3 - methyl -, 139⁷.
- C₁₅H₁₇N₂O₂S Indole, 4, 5, 6, 7 - tetrahydro - 2 - methyl -, benzenesulfonate, 1635⁴.
- p - Toluenesulfonic acid, phenethylamine salt, 1898⁴.
- C₁₅H₁₇NO₂ Codinal, dihydro-, 2079⁹.
- Malonic acid, (phenyl-1 - piperidyl)methyl -, 1897⁹.

- Nipecotie acid, 4 - Hydroxy - 2,6 - dimethyl - , benzoate, and - HCl, P 1995⁷.
- C₁₅H₁₉NO₅ o - Diacetotoluide, 4 - (β - hydroxy - ethoxy) -, acetate, 1888⁸.
- Tyrosine, N - acetyl -, Et ester, acetate, 5161⁹.
- C₁₅H₁₉NO₅ Protocatechuy alcohol, α - (α - aminoethyl) -, 3,4 - diacetate, oxalate, 5162⁹.
- C₁₅H₁₉N₂O₈ Oxazolidine, 3 - (allylthiocarbamyl) - 5 - (benzylmercaptomethyl) - 2 - imino -, 2177⁸.
- Δ¹ - Oxazoline, 2 - (β - allylthiocarbamid) - 5 - (benzylmercaptomethyl) -, 2177⁸.
- C₁₅H₁₉N₂O₈ Flavianic acid, choline deriv., 4702¹.
- C₁₅H₁₉N₂O₈ Glycine, N - [N - (N - phenyl - carbamylglycyl)glycylglycyl] -, 1389⁷.
- C₁₅H₂₀ Cyclohexane, 1,1 - dimethyl - 3 - methylene - 2 - phenyl -, 4453².
- C₁₅H₁₉ClNO₄ Diconal, chlorodihydro -, -HCl, 2979⁸, 2980¹.
- C₁₅H₁₉N₂ Formaldehyde, methyl(methylcyclohexenylphenyl)hydrazone, 4690⁷.
- C₁₅H₁₉N₂O₂ Cycloheptanone, 2 - methyl -, oxime, carbanilate, 2702⁹.
- Δ¹ - 3 - Pyrazolinecarboxylic acid, 4 - phenyl -, Am ester, 3704¹.
- C₁₅H₁₉N₂O₄ 2 - Piperidineethanol, 1 - methyl -, p - nitrobenzoate, - HCl, 1902².
- 1 - Piperidinol, 1 - propyl -, p - nitrobenzoate, - HCl, 1902².
- C₁₅H₁₉N₂O₄ Benzyl alcohol, α - aulino β - methyl -, acid sulfate, guanidine salt, 5171⁴.
- Benzyl alcohol, α - p - toluino -, acid sulfate, guanidine salt, 5171⁴.
- C₁₅H₂₀N₂O₄ Alanine, N - [N - (N - glycylglycylglycyl) - β - phenyl] -, 2992⁹.
- Butyric acid, α - [N - (N - phenylcarbamylglycyl)glycylaminol] -, 2993².
- Glycine, N - [N - (N - β - phenylalanylglycyl)glycyl] -, 2992⁹.
- N - [N - α - (β - phenylcarbamido) - butyryl]glycyl -, 2993¹.
- C₁₅H₁₉N₂O₇ Indole, octahydro - 2 - methyl -, picrate, 144².
- C₁₅H₁₉N₂O₈ Isopelletierine, N - methyl -, picrate, 1132¹.
- C₁₅H₁₉N₂O₈ Guanidine, α - phenyl -, carbonate, 1390⁴.
- C₁₅H₁₉O Acetophenone, β - 3 - methylcyclohexyl -, 4690⁷.
- Cinnamaldehyde, diisopropyl -, P 1649⁶.
- Δ¹ - 3 - Nonenone, 1 - phenyl -, 3696⁴.
- Δ¹ - 3 - Octenone, 7 - methyl - 1 - phenyl -, 3696⁴.
- C₁₅H₁₉O₂ Δ¹ - 2 - Butenone, 4 - (6 - methoxythymyl) -, 1123¹.
- Cinnamaldehyde, α - amyl - β - methoxy -, P 3714⁶.
- 1,2 - Cyclohexanediol, 1 - phenyl -, acetone compd., 2701⁴.
- C₁₅H₁₉O₂ Carbonic acid, cyclohexyl phenethyl ester, 124¹.
- Cinnamic acid, β - butoxy -, Et ester, 1396⁹.
- Kessotriketone, 3455⁷.
- C₁₅H₁₉O₂ Benzoic acid, o - (γ - carboxypropyl) -, di - Et ester, 137⁸.
- C₁₅H₁₉O₂ Methysticline acid, hexahydro -, 2966⁴.
- C₁₅H₁₉O₂ Glucoside, benzal-β - methyl - (methyl) -, 109¹.
- C₁₅H₁₉O₁₀ Rhamnohexonolactone, tetraacetyl -, 2942¹.
- C₁₅H₁₉AlO₈ 2,4 - Pentanedione, Al deriv., 2421⁴.
- C₁₅H₁₉BrN₂S Benzothiazole, 5 - bromo - 1 - heptylamino - 3 - methyl -, and - HBr, 835⁹.
- C₁₅H₁₉ClN₂O₇ γ - Chloroallyltriethylammonium picrate, 2150⁶.
- C₁₅H₁₉IN₂S Pseudothiopyrine, BuI deriv., 4701².
- C₁₅H₁₉N Xeuylamine, 2',3',4',5' - tetrahydro - trimethyl -, 4688⁴.
- C₁₅H₁₉NO β - Penteno - p - toluid, α,α,β - trimethyl -, 1119⁹.
- C₁₅H₁₉NO₂ (See also *Eucaine*.)
- Cinnamic acid, β - diethylaminoethyl ester, - HCl, 2500¹.
- 4 - Piperidinol, 1 - propyl -, benzoate, - HCl, 1902².
- C₁₅H₁₉NO₂S Indole, octahydro - 2 - methyl - 1 - phenylsulfonyl -, 144².
- C₁₅H₁₉NO₂ Homopiperonyl alcohol, α - (1 - piperidylmethyl) - (?), and salts, 4683¹.
- 1 - Piperidineethanol, β - piperonyl - (?), and salts, 4683¹.
- C₁₅H₁₉NO₂S Indole, 2,3,4,5,6,7 - hexahydro - 2 - methyl -, benzenesulfonate, 1635⁶.
- 4 - Piperidone, 2,2,6 - trimethyl - 1 - p - tolylsulfonyl -, 2935².
- C₁₅H₁₉NO₂ Glycine, N - acetyl - N - (2 - methyl - β - phenetyl) -, Et ester, 1888².
- Malonic acid, (α - aminobenzyl)methyl -, di - Et ester, - HCl, 1892².
- C₁₅H₁₉N₂O: See *Physostigmine*.
- C₁₅H₁₉N₂O: Leucine, N - (N - phenylcarbamylglycyl) -, 1389⁷.
- C₁₅H₁₉ Hydrocarbon from a Ph naphthenate, 4455⁹.
- Mesitylene, 2 - cyclohexyl -, 4936⁴.
- β - Xylene, 2 - (methylcyclohexyl) -, 4937⁴.
- C₁₅H₁₉BrN₂S Benzothiazole, 4 - heptylamino - 3 - methyl -, hexabromide, 835⁹.
- C₁₅H₁₉IN (p - Δ¹ - Cyclohexenylphenyl)trimethylammonium iodide, 4688⁴.
- C₁₅H₁₉N₂O₂ 2 - Piperidineethanol, 1 - methyl -, p - aminobenzoate, - HCl, 1902².
- 4 - Piperidinol, 1 - propyl -, p - aminobenzoate, - HCl, 1902².
- C₁₅H₁₉N₂O: Alanine, N - leucyl - β - phenyl -, 1112¹.
- Glycine, N² - leucyl -, benzyl ester, - HCl, 603¹.
- C₁₅H₁₉N₂O: 1 - Propanol, 3 - diethylamino - 2 - methoxy -, β - nitrobenzoate, - HCl, P 3234¹.
- C₁₅H₁₉N₂S Benzothiazole, 1 - heptylamino - 3 - methyl -, 835⁹.
- C₁₅H₁₉N₂O₇ Cyclohexylamine, N - isopropyl -, picrate, 111¹.
- C₁₅H₁₉N₂O₈ Triethyl(α - hydroxyallyl)ammonium picrate, 2150⁶.
- C₁₅H₁₉O Ether, o (and p) - cyclohexylphenyl propyl, 4937⁴.
- C₁₅H₁₉O₂ Benzyl alcohol, diisopropyl -, acetate, P 1649⁶.
- Compd., bp 175-8°, from compd. bp 240⁹, 4690⁷.
- Cyclohexanol, 4 - (p - hydroxy α,α - di - methylbenzyl) -, 4689⁹.
- C₁₅H₁₉O₂ Δ¹ - 1,1,3,3 - Propenetetra-carboxylic acid, tetra - Et ester, 101⁴.
- C₁₅H₁₉O₂ Mannose, triacetylmonoacetone -, 107¹.
- C₁₅H₁₉O₁₀ Galactoside, 2,3,4,6 - tetraacetyl - α - methyl -, 1117¹.

- Gluconide, tetraacetyl - β - methyl -, 1881⁵.
 Mannoside, tetraacetyl methyl-, 102⁶.
 C₁₆H₂₃BrN₂S Urea, α - (5 - bromo - *o* - tolyl) - β - heptylthio-, 835⁹.
 C₁₆H₂₃NO α - Curcumene, oximino -, 149⁹.
 C₁₆H₂₃NO₂ 1 - Hexanol, 2,2 - dimethyl -, carbanilate, 125¹.
 Hydrocinnamic acid, β - diethylaminoethyl ester, - HCl, 5236⁹.
 C₁₆H₂₃NO₂ Benzoic acid, ethoxy - 2 - [β - (ethylmethylamino)ethyl]methoxy-, 2979³.
 C₁₆H₂₃N₂O 2 - Butanone, 4 - carvacrylsemicarbazone, 5470².
 C₁₆H₂₃N₂O₂ Urea, α , α - dibutyl, picrate, 344⁹.
 C₁₆H₂₄ Aromadendrene, 136².
 Bisabolene, 3455¹.
 Cadinene, 1127¹, 4138¹.
 Caryophyllene, 1127¹, 2433¹.
 Cedrene, 4138¹.
 Clovene, 4464⁴.
 Curcumene, 149⁹, 150¹.
 Eudesmene, 931³.
 Heptane, 2 - methyl - 6 - *p* - tolyl -, 3455⁴.
 Humulene, 2433¹.
 Inene, 4138¹.
 Isoclovene, 4464⁴.
 Isozingiberene, and di-HCl, 3455³.
 Zingiberene, 3455³.
 C₁₆H₂₃ClNO, α - Curcumene, oximino-, - HCl, 149⁹.
 C₁₆H₂₃CuN₂, 1587¹.
 C₁₆H₂₃IN (*p* - Isohexenylphenyl)trimethylammonium iodide, 4689¹.
 C₁₆H₂₃N₂ Butyramidine, *N*, *N* - diethyl - α - methyl - *N'* - phenyl -, and chloroplatinate, 3208².
 C₁₆H₂₃N₂O Lupanine, *gnd* - HCl, P 612⁴.
 Matrine, 2437¹.
 C₁₆H₂₃N₂O₂ 1 - Propanol, 3 - diethylamino - 2 - methoxy -, *p* - aminobenzoate, - HCl, P 3234¹.
 C₁₆H₂₃N₂O₂ Heptylamine, *N* - (4,5 - dimethoxy - 2 - nitrophenyl) -, 4204⁹.
 C₁₆H₂₃N₂O₂ Mannonic acid, trimethyl -, phenylhydrazide, 2423¹.
 C₁₆H₂₃N₂S Urea, α - heptylthio - β - *o* - tolyl-, 835⁹.
 C₁₆H₂₃O See *Euphorbone*.
 C₁₆H₂₃O₂ Cyclohexanone, 4,4' - isopropylidenebis-, 4689¹.
 C₁₆H₂₃O₂ 1,2 - Hexanediole, 1 ϕ - anisyl - 2 - ethyl-, 4687^{1,3}.
 C₁₆H₂₃O₂ Phthalic acid, cyclohexyl Me ester, P 1128⁹.
 C₁₆H₂₃O₂ Cyclopentanemalononic acid, 1 - acetonyl-, di-Et ester, 3673¹.
 C₁₆H₂₃O₂ 5,5' - Spiro[bi(m - dioxane)] - 2,2' - dicarboxylic acid, 2,2' - dimethyl -, di - Et ester, 99⁷.
 C₁₆H₂₃O₂ Aucubin, 393^{2,4}.
 Gluconide, 3,4,6 - triacetyl - β - isopropyl -, 1881⁴.
 —, 3,4,6 - triacetyl - 2 - methyl - β - ethyl -, 1881⁴.
 C₁₆H₂₃Cl α - Curcumene, - HCl, 149⁹.
 C₁₆H₂₃KO Amyrol, K deriv., 1127².
 C₁₆H₂₃N₂O Aromadendrene, semicarbazone, 136².
 C₁₆H₂₃P Phosphine, dibutyl - *p* - tolyl -, and HgCl₂ addn. compd., 2150⁹.
 Phosphine, diisobutyl - *p* - tolyl -, 4442².
 C₁₆H₂₃ Aromadendrene, dihydro-, 136².
 Zingiberene, dihydro-, 3455⁴.
 C₁₆H₂₃BrP Phenyltripropylphosphonium bromide, 4442¹.
 C₁₆H₂₃IP Dibutylmethylphenylphosphonium iodide, 2150⁹.
 Diisobutylmethylphenylphosphonium iodide, 4442².
 C₁₆H₂₃N₂ See *Sparteine*.
 C₁₆H₂₃O Amyrol, 1127⁴.
 β - Caryophyllene alcohol, 4464⁹.
 Cedrol, 2242⁴.
 Compd. from *Sphacele parviflora*, 1213⁹.
 Eudesmol, 931³.
 Farnesol, P 1724⁹, 5272².
 Isoclovene alcohol, 4464⁹.
 α , γ - Octadienaldehyde, α - amyl - γ - ethyl -, P 3714⁹.
 C₁₆H₂₃O₂ Kessyl alcohol, 3455⁹.
 C₁₆H₂₃O₂ Δ^1 - Cyclohexeneacetic acid, 5 - isoamoxy - (?), Et ester, 1131³.
 Kessoglycerol, 3455⁷.
 Kessoglycol, 3455⁷.
 C₁₆H₂₃O₂ Spiro[camphane - 2,2' - *m* - dioxane] - 5,5' - dicarbinol, 4672⁹.
 C₁₆H₂₃O₂ 1,1 - Cyclobutanedicarboxylic acid, 3 - amoxy -, di-Et ester, 2700⁹.
 Phoronic acid, di-Et ester, 1623⁷.
 C₁₆H₂₃O₂ Butyrin, 1923⁹.
 C₁₆H₂₃CoN₂O₂ *tert* - Propoxoniumhexacyanocobaltate, 4194¹.
 C₁₆H₂₃N α - Curcumenylamine, dihydro -, 149⁹.
 C₁₆H₂₃N₂O₂ Acetanilide, *ar* - hexahydro - *N* - (γ - hydroxy - α - methylbutyl) -, acetate, 112⁷.
 C₁₆H₂₃N₂O₂ Acetaldehyde, dicyclohexyl -, semicarbazone, 113⁹.
 Acetophenone, α - cyclohexylhexahydro -, semicarbazone, 113⁹.
 C₁₆H₂₃ Bisabolene, tetrahydro-, 3455².
 C₁₆H₂₃Cl₂O₂ Lauric acid, β , β' - dichloroisopropyl ester, 3913⁴.
 C₁₆H₂₃N₂ Compd. from sparteine, salts, 5188⁹.
 C₁₆H₂₃N₂O₂ 1 - Piperazinecarboxylic acid, Et ester, CS₂ addn. compd., 2183⁹.
 C₁₆H₂₃O Amyrol, dihydro-, 1127⁴.
 Cyclopentadecanone, 1111¹, 4536¹.
 α - Octenaldehyde, α - amyl - γ - ethyl -, P 3714⁹.
 C₁₆H₂₃O₂ Capric acid, α - cyclopentyl -, P 3543⁹.
 Cyclohexanepelargonic acid, P 848⁴.
 Cyclohexanol, 4,4' - isopropylidenebis-, 4689¹.
 Isovaleric acid, menthyl ester, 474¹.
 Pentadecanoic acid, ξ - hydroxy -, lactone, 1111¹, P 1911¹, P 2725⁴, P 4483⁹.
 C₁₆H₂₃O₂ 3 - Hexanone, 4 - hydroxy - 2,2,5,5 - tetramethyl -, pivalate, 2936¹.
 C₁₆H₂₃O₂ Cyclohexeneacetic acid, 1 - hydroxy - 3 - isoamoxy -, Et ester, 1131³.
 Sabinic acid, Me ester, acetate, 3664¹.
 μ - Tridecoic acid, μ - hydroxy -, acetate, 3664¹.
 C₁₆H₂₃BrO₂ Pentadecanoic acid, ξ - bromo -, 3684¹.
 C₁₆H₂₃NO Campholamide, *N* - amyl -, 3208⁹.
 C₁₆H₂₃N₂O₂ Sabinaldehyde, semicarbazone, acetate, 3664¹.
 C₁₆H₂₃ Curcumene, hexahydro-, 149⁹, 150².
 1 - Dodecene, 3,7,11 - trimethyl -, 4926¹.
 C₁₆H₂₃BrTe Telluropyran, pentamethylenbis[chromotetrahydro-, 1787².
 C₁₆H₂₃BrTe Telluropyran, pentamethylenbis[tribromotetrahydro-, 1787².
 C₁₆H₂₃ClTe Telluropyran, pentamethylenbis[chlorotetrahydro-, 1787².

- $C_{15}H_{21}Te_2$ Telluropyran, pentamethylenebis-[dodetetrahydro-, 1787³].
- $C_{15}H_{21}Te_2$ Telluropyran, pentamethylenebis-[tetrahydrotriiodo-, 1787³].
- $C_{15}H_{21}N_2O_4$ Malonic acid, bis(β - diethylaminoethyl) ester, and di-HCl, 597³.
- $C_{15}H_{21}N_2S_2$ Carbanilic acid, N-ethylhexahydro-dithio-, cyclohexylamine salt, P 608¹.
- $C_{15}H_{21}O_2$ Lauraldehyde, β , γ , κ -trimethyl-, 4926².
- $C_{15}H_{21}O_2$ Lauric acid, Pr ester, 4926².
- Pentadecanoic acid, 1108⁶, 1872², 4190¹, 4609⁶.
- Propionic acid, dodecyl ester, 4926².
- 1-Tetradecanol, formate, 4926².
- $C_{15}H_{21}O_2$ Myristic acid, ν -hydroxy-, Me ester, 3664⁴.
- Pentadecanoic acid, ξ - hydroxy -, 1111², 3664⁴.
- $C_{15}H_{21}O_2$ Laurin, α -mono-, 1876¹.
- $C_{15}H_{21}Br$ Dodecane, 1 - bromo - 3,7,11 - trimethyl-, 3702⁸.
- $C_{15}H_{21}N_3O$ Undecylaldehyde, α , ϵ , κ -trimethyl-, semicarbazone, 4926².
- $C_{15}H_{21}$ Pentadecane, 90².
- $C_{15}H_{21}O$ Farnesol, hexahydro -, 3702⁸.
- $C_{15}H_{21}O_2Te_2$ Telluropyran, pentamethylenebis-[tetrahydro-1-hydroxy-, 1787³].
- $C_{15}H_{21}N$ Pentadecylamine, and HCl, 2419¹.
- Trisoamylamine, -III-, 5088²; -H⁺CN, 5361⁴.
- $C_{15}H_{21}P$ Phosphine, triamyl-, 4412².
- Phosphine, trisoamyl-, 4442².
- , tris(β - methylbutyl)-, 4442².
- $C_{15}H_{21}As_2O_3S_2$ Arsine, (2 hydroxytrimethylene)-bis[bis(β , γ - dihydroxypropylmercapto)-, P 1649⁶.
- $C_{15}H_{21}BrN$ β - Ethyldecyltrimethylammonium bromide, 2934⁴.
- $C_{15}H_{21}As_2$ Pentarsenole, tetrahydropentapropyl-, 120².
- $C_{15}H_{21}Cl_2CoN_6$, 574⁴.
- $C_{15}H_{21}Cl_2N_6$, 574⁴.
- $C_{15}H_2Br_2Cl_2N_2O_2$ Indigotin, 5,5',7,7' - tetrabromo - 4,4',6,6'-tetrachloro-, 1891¹.
- $C_{15}H_2Br_2N_2O_2$ Indigotin, 4,4',5,5',6,6',7,7' - octabromo-, 1891¹.
- $C_{15}H_2Cl_2N_2O_2$ Anthraquinonedinitrile, dichloro-, P 717⁴, 4944².
- $C_{15}H_2Cl_2O_2$ 1,5 - Anthracenedicarboxylic acid, 4,8 - dichloro - 9,10 - dihydroxy -, dilactone, 4945¹.
- $C_{15}H_2Cl_2N_2O_2$ Indigotin, 5,5',6,6',7,7' - hexachloro-, 1891¹.
- $C_{15}H_2Br_2N_2O_2$ Indigotin, tetrabromo-, P 287².
- $C_{15}H_2Cl_2O_2$ 1,5 - Anthraquinonedicarbonyl chloride, 2711⁴.
- $C_{15}H_2Cl_2O_2$ Anthraquinonedicarboxylic acid, dichloro-, P 2447⁴, 4944².
- $C_{15}H_2INO_2$ Cinchophen, pentaiodo-, P 2088¹.
- $C_{15}H_2N_2O_2$ Anthraquinonedinitrile, P 717⁴, P 992⁴, 2711⁴.
- $C_{15}H_2N_2O_2S_2$ 2,6-Anthraquinonedisulfonic acid, 3,7 - dicyano-, P 2447⁴.
- $C_{15}H_2O_2$ 1,5 - Anthracenedicarboxylic acid, 9,10 - dihydroxy -, di - γ - lactone, 3701⁴, 4944².
- $C_{15}H_2O_2$ 1,5 - Anthraquinonedicarboxylic anhydride, 2710⁴, 2711⁴.
- $C_{15}H_2NO_2$ 1 - Anthraquinonecarboxylic acid, 5-cyano-, 2711⁴.
- $C_{15}H_2Br_2N_2O_2$ Quinoxaline - 2,3 - dicarboxy - p - bromo - o - phenylenediamide, 6 - bromo -, 3473¹.
- $C_{15}H_2Br_2O_2$ Anthraquinone, 1,3 - dibromo - 2 - hydroxy -, acetate, 2172⁴.
- $C_{15}H_2Cl_2N_2O_2$ Quinoxaline - 2,3 - dicarboxy - p - chloro - o - phenylenediamide, 6 - chloro -, 3173².
- $C_{15}H_2INO_2$ Cinchophen, triiodo-, P 2088¹.
- $C_{15}H_2N_2O_2$ 4,5 - $\alpha\beta$ - Naphthotriazoledione, 2 - (nitrophenyl) -, 4216⁷, 4217¹.
- $C_{15}H_2O_2S_2$ Benzo[β]thiophanthrene - 6,11 - dione, P 3583⁴.
- $C_{15}H_2O_2S_2$ Thioindico, 321, P 287¹.
- $C_{15}H_2O_2S_2$ Benzo[β]thiophanthrene - 6,11 - dione, 7,10 - d-hydroxy -, P 5328⁹.
- $C_{15}H_2O_2S_2$ Diphtalyl disulfide, 127¹.
- $C_{15}H_2O_2$ Spiro[2,1 - benzopyran - 3(4), 1'(2') - isobenzofuran] - 1,4,2' - trione (β), 1128⁸.
- $C_{15}H_2O_2S_2$ Benzo[β]thiophanthrene - 6,11 - dione, trihydroxy -, P 5328⁹.
- $C_{15}H_2O_2$ Anthraquinone-dicarboxylic acid, and Hg salt, 1898³, and salts, 2710⁶, 2711⁴.
- $C_{15}H_2O_2$ 1,3 - Anthraquinonedicarboxylic acid, 2 - hydroxy -, 2174².
- $C_{15}H_2O_2S_2$ 2,6 - Anthraquinonedicarboxylic acid, 3,7-disulfo-, P 2447⁴.
- $C_{15}H_2Br_2O_2$ Anthraquinone, 1 bromo - 2 - hydroxy-, acetate, 2173².
- $C_{15}H_2Br_2NO_2S_2$ 2 - Naphthalenesulfonic acid, 4 - (3,5 - dibromo - 4 - hydroxyphenyl imino) - 1,4 - dihydro - 1 - keto -, 3451¹.
- $C_{15}H_2Br_2N$ 1 - Naphthylamine, N - phenyl -, tetrabromo deriv., 3709⁴.
- $C_{15}H_2Cl_2NO_2S_2$ 2 - Naphthalenesulfonic acid, 1 - (3,5 - dichloro - 4 - hydroxyphenyl imino) - 1,4 - dihydro - 1 - keto -, 3451¹.
- $C_{15}H_2HgNO_2$ Cinchophen, 3-(hydroxymercuri)-, cyclic anhydride, 3706⁷.
- $C_{15}H_2IO_2$ Anthraquinone, 2 - hydroxy - 3 - iodo-, acetate, 2173².
- $C_{15}H_2INO_2$ Cinchophen, diiodo-, P 2088¹.
- $C_{15}H_2NO_2$ 4,3 - Phenanthroxazole - 6,7 - dione, 2 - methyl -, 3466².
- $C_{15}H_2$ Butadiene, diphenyl-, 293⁶, 4439⁶.
- Fluoranthene, 2713¹.
- $C_{15}H_2Br_2Cl_2O_2$ 1,4 - Butanedione, 2,3 - dibromo -, 1,4 - bis(p - chlorophenyl)-, 5120³.
- $C_{15}H_2Br_2PO_2$ 2 - Naphthol, 1 - (2,5 - dibromophenylazo)-, 4456⁹.
- $C_{15}H_2Br_2NO_2$ Piperonal, 6 - bromo -, azine, 4201⁶.
- $C_{15}H_2Cl_2NO_2$ 5-(4 - Isoxazolone, 4 - benzal - 3 - (chlorophenyl)-, 3218⁹.
- $C_{15}H_2Cl_2NO_2$ Ether, 5 - chloro - 2 - nitrophenyl 2 - naphthyl, P 2188².
- $C_{15}H_2Cl_2NO_2$ 5-(4 - Isoxazolone, 3 - (chlorophenyl) - 4 - (3,4 - dihydroxybenzal) -, 3218⁹, 3219⁹.
- $C_{15}H_2Cl_2N_2O_2$ Piperonal, 6 - chloro -, azine, 4201⁶.
- $C_{15}H_2HgO_2$ Anthraquinone, (acetoxymmercuri)-tetrahydroxy-, 3463¹.
- $C_{15}H_2N_2$ Homoterephthalonitrile, α -benzal -, 2176⁹.
- Malononitrile, diphenylmethylene-, 1111⁴.
- $C_{15}H_2N_2Na_2O_2S_2$ 1,1' - Bithionaphthene, 1,1',-2,2' - tetrahydro - 2,2' - isomro -, di - Na deriv., 3168².
- $C_{15}H_2N_2O_2$ (See also Indigotin)
- Indirubin, 321.
- 3,7(2) Naphthophthalazinedione, 4-methyl-, 4696¹.

- C₁₆H₁₀N₂O₄ Anthraquinonedialdehyde, diamino-, P 1142⁴.
- C₁₆H₁₀N₂O₅ Anthraquinonedicarboxylic acid, diamino-, P 850¹.
- C₁₆H₁₀N₂S₂ Δ^{1,1'}(3,3') - Bithionaphthene, 2,2' - diimino-, *and* -HCl, 3468⁹.
- C₁₆H₁₀N₂O₃ Quinoxaline - 2,3 - dicarboxy - *o* - phenylenediamide, 3472⁹.
- C₁₆H₁₀N₂O₄ Quinoline, 6 - (2,4 - dinitrobenzal-amino)-, 4682⁹.
- C₁₆H₁₀N₂O₅ 1,2,5 - Triazole - 3 - carboxylic acid, 4 - (*o* - carboxyphenyl) - 1 - (nitrophenyl) -, 4217^{1,2}.
- C₁₆H₁₀N₂O₃ Piperonal, 6 - nitro-, azine, 4204³.
- C₁₆H₁₀N₂O₅ Isoquinoline, 6,7 - methylenedioxy -, picrate, 2444⁴.
- C₁₆H₁₀O₂ Anthraquinone, acetyl-, P 745⁷, P 1512³, P 4949⁹, P 5474⁴.
- 1 - Anthroic acid, 9,10 - dihydroxy -, 2 - methyl -, γ - lactone, 4695⁷.
- C₁₆H₁₀O₄ Coumarin, 3 - (3,4 - methylenedioxyphenyl)-, 1634⁵.
- 3 - Phenanthrenecarboxylic acid, 9,10 - dihydro - 9,10 - diketone -, Me ester, 5472⁴.
- Phenanthrenequinone, 1 - hydroxy -, acetate, 4468⁹.
- C₁₆H₁₀O₄ Umbelliferone, 3 - (3,4 - methylenedioxyphenyl) -, 1634⁵.
- Xanthopurpurin, 1 - acetate, 4697⁷.
- C₁₆H₁₀O₅ 1,5 - Anthracenedicarboxylic acid, 9,10 - dihydroxy -, 3701³.
- Benzoic acid, *o,o'* - oxalylbis -, *and* salts, 1128⁷.
- Coumarin, 5,7 - dihydroxy - 3 - (3,4 - methylenedioxyphenyl)-, 1634⁵.
- C₁₆H₁₀O₅ Disulfide, bis(*o* - carboxybenzoyl), 127¹.
- C₁₆H₁₀O₇ Naphthalic anhydride, 3,4 - dihydroxy-, diacetate, 4213¹.
- C₁₆H₁₀S₂ 1,2' - Bithionaphthene, 3469¹.
- C₁₆H₁₁AsBrN γ - Benzophenarsazine, 7 - bromo -, 7,12-dihydro-, 4474⁴.
- C₁₆H₁₁AsClN γ - Benzophenarsazine, 7 - chloro -, 7,12-dihydro -, 4474⁴.
- C₁₆H₁₁AsIN γ - Benzophenarsazine, 7,12 - dihydro - 7 - iodo -, 4474⁴.
- C₁₆H₁₁BrO₃ 9 - Fluoreneglyoxylic acid, 9 - bromo-, Me ester, 832³.
- C₁₆H₁₁ClIN₂O₂ Glyoxylohydroxamyl chloride, oxime, dibenzoyl deriv., 4674⁵.
- C₁₆H₁₁ClO 1 - Anthroyl chloride, 2 - methyl -, 4696⁷.
- C₁₆H₁₁ClO₂ 9 - Anthroic acid, 10 - chloro - 3 - methyl-, 1130³.
- C₁₆H₁₁Cl₂NO₂ Phthalimide, *N* - (2,6 - dichloro - *p* - phenetyl) -, 3910⁴.
- C₁₆H₁₁Cl₂NO₂ *m* - Benzenedisulfonyl chloride - 5 - nitro -, compd. with naphthalene, 2428³.
- C₁₆H₁₁NO Phenanthroazole, methyl-, 3465⁹, 3466⁹.
- C₁₆H₁₁NO₂ Thionaphth[3,2 - β]indole, 10 - acetyl-, 4700⁶.
- C₁₆H₁₁NO₂ (See also *Cinchophen*.)
- 1 - *meso* - Anthrapyrrrol - 6(2) - one, 5 - hydroxy - 4 - methyl -, 2174³.
- Cinnamic acid, α - benzalamino - β - hydroxy-, lactone, 1120³, 3914⁴.
- 2 - Indene - p - benzamide, 1 - keto -, 2176³.
- C₁₆H₁₁NO₂ Anthr[2,1] - p - isothiazine - 7,12 - dione, 2,3 - dihydro -, P 2834⁷.
- C₁₆H₁₁NO₂ 1,2' - Bithionaphthene, 1,2 - dihydro - 2 - nitro -, 3469¹.
- C₁₆H₁₁NO₂ Anthraquinone, 2 - acetyl - 1 - amino-, P 1142⁴.
- 1 - Anthraquinonecarboxamide, 2 - methyl-, 4696⁹.
- Oxazole, 2 - (3,4 - methylenedioxyphenyl) - 5 - phenyl-, *and* -HCl, 2716⁹.
- 2,3 - Quinolinediol, 3 - benzoate, 2442⁹.
- C₁₆H₁₁NO₂ 2 - Anthraquinonecarboxylic acid, 4 - (aminomethyl) - 3 - hydroxy -, 2174³.
- C₁₆H₁₁NO₂S 2 - Naphthalenesulfonic acid, 1,4 - dihydro - 4 - (*p* - hydroxyphenylimino) - 1 - keto -, 3450⁹.
- C₁₆H₁₁NO₃ Anthraquinone, 1,2 - dimethoxy - 3 - nitro-, 4697⁹.
- C₁₆H₁₁NS₂ Thionaphthene, 2,2' - iminobis -, 3468⁹.
- C₁₆H₁₁N₂O 2,1,3 - Benzotriazole, 2 - (hydroxynaphthyl), 836⁴.
- C₁₆H₁₁N₂O₂ Pyrazol[5,4 - γ]quinoline - 1,4(2,5) - dione, 2 - phenyl -, 2443⁷.
- C₁₆H₁₁N₂O₂ See *Para red*.
- C₁₆H₁₁AgN₂O₂ Malonanilide, α - cyano -, λ deriv., 4193⁷.
- C₁₆H₁₁As₂NO₂ 1,4 - Benzisoxazin - 3 - ol, 6,6' - arsenobis-, 841⁴.
- C₁₆H₁₁BrNO₂S Anthraquinone, amino (bromomethyl-mercapto)-, P 3109³.
- C₁₆H₁₁Br₂ Anthracene, bromo (bromomethyl) methyl-, 5183^{2,4}.
- C₁₆H₁₁Br₂O₂S Acetophenone, α,α' - thiois[*p* - bromo -, 1629⁴.
- C₁₆H₁₁Br₂O₂ Acetophenone, oxybis[α - bromo -, P 396⁴, P 3931⁷.
- C₁₆H₁₁ClNO Aniline, 4 - chloro - 2 - (2 - naphthoxy) -, P 2188³.
- C₁₆H₁₁ClNO₂ Oxazole, 5 - *p* - anisyl - 2 - (chlorophenyl)-, *and* -HCl, 2716⁹.
- C₁₆H₁₁ClNO₂S Naphthalenesulfonanilide, chloro -, 1897¹.
- C₁₆H₁₁ClN₂O₂ Hydrocinnamic acid, chloro - α,β - diketone -, Me ester, α - *p* - nitrophenylhydrazone, 3218⁷.
- C₁₆H₁₁Cl₂O₂ Acenaphthene, bis(chloroacetyl) -, P 1137⁷, P 1417⁹.
- C₁₆H₁₁Cl₂O₂ Acetophenone, oxybis[α - chloro -, P 396⁴, P 3931⁷.
- C₁₆H₁₁Cl₂O₂ Acetophenone, α,α' - hydroxy - α,α' - oxybis[α - chloro -, P 3931⁷.
- C₁₆H₁₁Cl₂O₂ Acetophenone, oxybis[α - chloro - α - hydroxy-, P 396⁴.
- C₁₆H₁₁N₂O Imidazole, 2 - benzoyl - 5 - phenyl -, 602⁹.
- 2 - Pyrazinol, 3,6 - diphenyl-, 602⁹.
- C₁₆H₁₁N₂O₂ Thiazole, 2 - benzamido - 4 - phenyl -, 2177³.
- C₁₆H₁₁N₂O₂ 4,4' - Bibenzoxazole, 1,1' - dimethyl-, 2161¹.
- Cinchonohydroxamic acid, 2 - phenyl -, 4470⁴.
- Oxazole, 2 - benzamido - 4 - phenyl -, 2177³.
- C₁₆H₁₁N₂O₂S 1,8 - Naphthosultam, 3 - anilino -, P 613⁹.
- C₁₆H₁₁N₂O₂ 2 - Indolecarboxylic acid, 1 - methyl - 3 - (*o* - nitrophenyl) -, 4699⁹.
- Isatide, 996⁹.
- Isatin piccol, 2970³.
- Oxazole, 5 - *p* - anisyl - 2 - (nitrophenyl) -, 2716⁹.
- C₁₆H₁₁N₂O₂S Benzenesulfonic acid, - hydroxy - 1 - naphthylazo -, deriv., 3461⁴.
- C₁₆H₁₁N₂O₂S 1,1' - Bithionaphthene, 1,1',2,2' - tetrahydro - 2,3' - dinitro -, 3468⁹.
- C₁₆H₁₁N₂O₂S Phenylsulfuric acid, *p* - (2 hydroxy - 1 naphthylazo)-, *K* salt, 2160⁹.

- $C_{16}H_{13}N_3O_5$: 2 - Naphthol - 6 - sulfonic acid, phenylazo-, acid sulfite, *di-Na salt*, 3462⁴.
- $C_{16}H_{13}N_3O_5$ + H_2O : 2 - Naphthol - 3,6 - disulfonic acid, phenylazo-, acid sulfite, *tri-Na salt*, 3462⁴.
- $C_{16}H_{13}N_3S$: Thiazole, 2 - benzalamino - 4 - phenyl-, 2177⁴.
- $C_{16}H_{13}N_3S$: 1,1' - Bithionaphthene, 2,2' - diamino -, 3468⁴.
- $C_{16}H_{13}N_4$: 2,1,3 - Benzotriazole, 5 - amino - 2 - naphthyl-, 830⁴.
- $C_{16}H_{13}N_4O_2$: Hydrazine, β - acetyl - α,α - bis - (p - thiocyanophenyl) -, 2245².
- $C_{16}H_{13}N_4O$: Lepidine, picrate, P 607⁴.
- $C_{16}H_{13}N_4O_2$: Isoquinoline, 3,4 - dihydro - 6,7 - methylenedioxy-, picrate, 2444².
- $C_{16}H_{13}N_4O_3$: Tartazine, 2107⁴.
- $C_{16}H_{13}O$: 4(5) - Fluoranthene, 6,6a - dihydro -, 2713².
- Ketone, anthryl methyl, P 715⁴.
- 2-Naphthol, phenyl-, 3408².
- $C_{16}H_{13}O_2$: 1 - Anthroic acid, 2 - methyl -, 4696⁴.
- 3 - Phenanthrenecarboxylic acid, Me ester, 5472².
- 1 - Phenanthrol, acetate, 4468².
- $C_{16}H_{13}O_2$: Anthraquinone, methoxymethyl -, 3466², 4696², 4697².
- Chalcone, 3,4 - methylenedioxy -, 2170².
- Coumarin, 3 - p - anisyl -, 1634⁴.
- Δ^2,α - Fluoreneacetic acid, α - hydroxy -, Me ester, 8317⁴.
- Succinic anhydride, α,β - diphenyl -, 2165⁴.
- $C_{16}H_{13}O_2$: Anthraquinone, 1 - hydroxy - 2 - methoxy - 6 - methyl -, 2174⁴.
- 1 - Anthroic acid, 9,10 - dihydroxy - 2 - methyl-, 4696².
- 1(2) - Benzofuranone, 2 - hydroxy - 2 - phenyl-, acetate, 2714².
- Phenanthrenequinone, 3,6 - dimethoxy -, 4469¹.
- $C_{16}H_{13}O_3$: Thioxanthone, 1(and 4) - hydroxy - 4(and 1) - methoxy -, acetate, 4472².
- $C_{16}H_{13}O_3$: Anthraquinone, 1 - hydroxy - 2,7 - dimethoxy -, 4214².
- 4 - Fluoreneacetic acid, 9 - keto - 1,6 - dimethoxy -, 4469¹.
- $C_{16}H_{13}O_3$: Spiro[thioxane - 2,9' - xanthene] - 6 - one, 3',6' - dihydroxy -, 1899².
- $C_{16}H_{13}O_4$: Chalcone, trihydroxymethylenedioxy -, 2431².
- Compd. from *gingko biloba* leaves, 1930⁴.
- Flavanone, 5,7 - dihydroxy - 3',4' - methylenedioxy-, 837¹.
- Tectorigenin, 2718¹.
- $C_{16}H_{13}O_5$: Spiro[thioxane - 2,9' - xanthene] - 6 - one, 1',3',6',8' - tetrahydroxy -, 1899².
- $C_{16}H_{13}O_4$: Isoflavone, 3',4',5',6',7 - hexahydroxy - 2 - methyl -, 2180².
- $C_{16}H_{13}O_5$: Myricetinsulfonic acid, monomethyl-, 2181².
- $C_{16}H_{13}Si$: Silicane, tetra - 2 - thienyl -, 4699².
- $C_{16}H_{13}Br$: Anthracene, (bromomethyl)methyl -, 5183⁴.
- $C_{16}H_{13}BrO_2$: Chalcone, α - bromo - β - methoxy -, 4941².
- $C_{16}H_{13}BrO_2$: Propiophenone, α - bromo - p - hydroxy-, benzoate, P 3723⁴.
- $C_{16}H_{13}ClN_2O_2$: Hydrocinnamic acid, chloro - α,β - diketo -, Me ester, α - phenylhydrazine, 3218².
- $C_{16}H_{13}ClO$: 9 - Fluorenepropionyl chloride, 2713².
- $C_{16}H_{13}ClO_4$ + H_2O : Dye, decomps. 236-7°, from sakuranetin, 148².
- $C_{16}H_{13}ClO_5$: Dye, m. 231-2°, from hesperitin, 148².
- Syringyl chloride, benzoate, 2181⁴.
- $C_{16}H_{13}ClO_7$: Delphinidin chloride, mono-Me ether, 2462².
- $C_{16}H_{13}Cl_2NO_3$: p - Phenetidine, dichloro - N - piperonylidene-, 3910², 3911⁴.
- $C_{16}H_{13}Cl_2NO_3$: 1,3 - Benzodioxan - 6 - sulfonamide, 2,4-bis(dichloromethyl)-, 2975².
- $C_{16}H_{13}I_2NO_6$: Alanine, β - [4 - (p - hydroxyphenoxy) - 3,5 - diiodophenyl] -, formyl deriv., 1631².
- $C_{16}H_{13}I_2NO_4$: Thyroxine, Me ester, *and* -HCl, 1632¹.
- $C_{16}H_{13}N$: α - Benzocarbazole, 5,6 - dihydro -, 137².
- $C_{16}H_{13}NO$: 4(5) - Fluoranthene, 6,6a - dihydro-, oxime, 2713².
- Oxazole, phenyl - p - tolyl -, *and* -HCl, 2716².
- Phenol, naphthylamino-, P 2044².
- Quinoluc, 2 - p - anisyl -, 392².
- $C_{16}H_{13}NO$: Acetamide, N - (2 - hydroxy - 1 - phenanthryl)-, 3465².
- Succinimide, α,β - diphenyl -, 1634².
- α - Tolunitrile, α - phenoxyacetyl -, 4481².
- $C_{16}H_{13}NO_2$: Acetamide, N - (9,10 - dihydroxy - 2 - anthryl) -, P 607⁴.
- 9 - Fluoreneglyoxylic acid, Me ester, oxime, 832².
- $C_{16}H_{13}NO_3$: Anthraquinone, amino(hydroxyethylmercapto)-, P 3109².
- Naphtholsulfonamide, 3909¹.
- $C_{16}H_{13}NO_3$: Anthraquinone, 3 - amino - 1,2 - dimethoxy -, 4697².
- 4 - Fluoreneacetic acid, 9 - keto - 1,6 - dimethoxy-, 4469¹.
- $C_{16}H_{13}NO_3$: 2 - Propanone, 1 - hydroxy - 3 - phenyl-, p - nitrobenzoate, 826².
- $C_{16}H_{13}NO_3$: Benzoic acid, o - (4 - ethoxy - 3 - nitrobenzoyl)-, P 1418².
- $C_{16}H_{13}NO_3S$: Naphthol-sulfonic acid, (phenylsulfamyl)-, P 3810².
- $C_{16}H_{13}NS$: Bithionaphthene, aminodihydro-, *and* -HCl, 3468², 3469¹.
- $C_{16}H_{13}N$: 2 - ¹Naphthylamine, phenylazo -, 3459².
- $C_{16}H_{13}NSO_2$: Oxazole, 4 - phenyl - 2 - (β - phenylthiocarbamido) -, 2177².
- Δ^2 - 1 - Pyrrolizinecarboxanilide, 5 - keto - 3 - phenylthio-, 388².
- $C_{16}H_{13}N_2O$: Malonanilide, α -cyano-, 4195².
- Phthalaz - 1 - one, 3' - amino - 3 - phenyl -, acetyl deriv., 1461².
- 1(2) - Phthalazone, 2 - (p - acetamidophenyl)-, 145².
- 1,3,4 - Triazole - 1 - o - benzoic acid, 2 - methyl - 5 - phenyl -, 8361².
- $C_{16}H_{13}N_2O_3$: Benzenesulfonic acid, p - (2 - amino - 1 - naphthylazo)-, *derms* -, 3461⁴.
- $C_{16}H_{13}N_2O_4$: Carbazole, 3 - diacetylaminonitro-, *and* sulfate, 3226².
- $C_{16}H_{13}N_2O_4$: Phthalazine - 4 - acetic acid, 1 - hydroxy - 3 - (3' - nitrophenyl) - 1,3 - dihydro -, 1461².
- $C_{16}H_{13}N_2O_5$: Phthalazine - 4 - acetic - - sulfonic acid, 3 - (3' - nitrophenyl) - 1,3 - dihydro-, *mono-Na salt*, 145².
- $C_{16}H_{13}N_2O_5$: Propiophenone, β -methoxy - m,α - dinitro - β - (nitrophenyl) -, 1163⁴.
- $C_{16}H_{13}N_2O_6$: Nitration product, m. 244°, from homopterocarpin, 2246².

- C₁₆H₁₃N₃S Thiazole, 2-phenylazo-4-*p*-tolyl-, 1410².
Thiazole, 4-phenyl-2-*o*-tolylazo-, 1410¹.
- C₁₆H₁₃N₃S₂ Thiazole, 4-phenyl-2-(β -phenylthiocarbamido)-, 2177⁸.
- C₁₆H₁₁Anthracene, dimethyl-, 5183^{2,4}.
Bistyril, 4465⁹.
Fluoranthene, 4,5,6,6a-tetrahydro-, 2713⁷.
Indene, tolyl-, 4213⁷.
- C₁₆H₁₁As₂Br₂N₂O₂ Acetanilide, 4,4'-arsenobis[3-bromo-, 3677⁸.
- C₁₆H₁₁As₂Br₂N₂O₄ Acetanilide, 3,3'-arsenobis[5-bromo-6-hydroxy-, 3677⁸.
- C₁₆H₁₁As₂N₂ Benzimidazole, arsenobis[2-methyl-, 2429⁹.
- C₁₆H₁₁As₂N₂O₄ 1,4-Benzisoxazin-3-ol, 6,6'-arsenobis[8-amino-, 841⁷.
- C₁₆H₁₁BrN₂O Δ^2 Isoxazoline, 5-(2-amino-4-bromophenyl)-4-imino-3-methyl-5-phenyl-, and *H Br*, 2974⁵.
- C₁₆H₁₁BrN₂O₂S Acetophenone, α , α' -thiobis[*p*-bromo-, dioxime, 1629⁸.
- C₁₆H₁₁ClNO Aniline, *p*-chloro-*N*-*p*-methoxy-cinnamal-, 3911⁸.
- C₁₆H₁₁ClNO₂ Hydrocinnamic acid, 2-benzamido-5-chloro-, 126¹.
- C₁₆H₁₁ClN₂ α -Tolunitrile, *p*-chloro- α -(*p*-dimethylaminophenylimino-), 4691¹³.
- C₁₆H₁₁ClN₂O₂S Hydrazine, α -(5-chloro-2-nitro-*p*-tolylsulfonyl)- β -cinnamal-, 3665².
- C₁₆H₁₁Cl₂N₂O₂S Acetophenone, α , α' -thiobis[*p*-chloro-, dioxime, 1629⁸.
- C₁₆H₁₁CuO₂ Methyl cuprisalicylate, 829^{8,4}.
- C₁₆H₁₁Cu₂O₇ Compd., from methyl hydroxycuprisalicylate, 829⁸.
- C₁₆H₁₁N₂ 1,3-Naphthylenediamine, 2-phenyl-, 4693⁸.
Phenylenediamine, naphthyl-, P 2044³.
 α -Tolunitrile, α -(α -phenyliminoethyl)-, 1126⁴.
- C₁₆H₁₁N₂O₂S 2(3 β) Thiazolone, 4-phenyl-3-*p*-toluino-, 1410⁶.
- C₁₆H₁₁N₂O₂ 4(5) Isoxazolone, 5-anilino-3-methyl-5-phenyl-, 2974⁵.
Phthalimidine, 2-(*m*-acetamidophenyl)-, 1461⁸.
- C₁₆H₁₁N₂O₂S Naphthalenesulfonanilide, amino-, 3909⁸.
- C₁₆H₁₁N₂O₂S Thiazole, 4-phenyl-2-*p*-tolylsulfonamido-, 2177⁸.
- C₁₆H₁₁N₂O₂S Naphthalenesulfonic acid, (*p*-aminoanilino)-, and *Na salt*, 3679⁸.
Naphthionic acid, *N*-(*p*-aminophenyl)-, 3679⁸.
- C₁₆H₁₁N₂O₄ Anthrarufin, 4,8-bis(methyl-amino)-, P 1143³.
- C₁₆H₁₁N₂O₂S 2-Naphthol-4-sulfonic acid, 1-(*p*-aminoanilino)-, 3679⁸.
- C₁₆H₁₁N₂O₄ Anthraquinone, 5-acetamido-1,2,3,4-tetrahydro-8-nitro-, P 2189⁸, P 5194⁴.
Mandelamide, *p*-methoxy-*N*-(*p*-nitrobenzal-), 2716⁷.
- C₁₆H₁₁N₂O₂ Nitration product, m. 122 $^{\circ}$, from homopterocarpin, 2246⁸.
- C₁₆H₁₁N₂O₂S Dibenzothiophene, 2,3,6,7-tetramethoxydinitro-, 9-dioxide, 3468⁹.
- C₁₆H₁₁N₂O₂S 1,3,4,6-Thiodiazine-2,5(3,4)-dione, 6-benzal-4-phenyl-, 2-hydrozone, 140⁸.
1,3,4,6-Thiodiazine-2,5(3,4)-dione, 4-phenyl-, azine with benzaldehyde, 140⁸.
1,2,4-Triazole, 5-benzamido-3-(methylmercapto)-1-phenyl-, 2178².
- C₁₆H₁₁N₂O₂S 1,3,4,6-Thiodiazine-2,5(3,4)-dione, 4-phenyl-, azine with salicylaldehyde, 140⁸.
- C₁₆H₁₁N₂O₄ 2,3-Quinoxalinedicarboxylic acid, *o*-phenylenediamine salt, 3472⁷.
- C₁₆H₁₁N₂O₂S Succinamide, α , β -bis(*p*-nitrophenyl)-, 4463⁴.
- C₁₆H₁₁N₂O₂S Acetanilide, 2,2'-thiobis[5-nitro-, 3468⁸.
Acetanilide, 2,2'-dithiobis[5-nitro-, 3468⁸.
- C₁₆H₁₁N₂O₂S 1,3,4-Thiodiazole, 2- β -phenylhydrazino-5-styryl-, 140⁸.
- C₁₆H₁₁N₂O₂S₂ Thiazolidine, 2-imino-3-(phenylthiocarbamyl)-, picrate, 2177⁸.
- C₁₆H₁₁N₂O₂S 1,2,4-Triazole, α , β -carboxanilide, 3-amino-5-methylthio-, picrate, 1633⁹.
- C₁₆H₁₁N₂S₂ 1,2,3,4-Tetrazole, 5,5'-ethylene-dithiobis[1-phenyl-, 4470⁸.
1,2,3,4-Tetrazole, 5,5'-ethylenedithiobis[1-phenyl-, 4470⁸.
1,2,3,4-Tetrazol-5(4)-one, 1,1'-ethylenedenebis[4-phenyl-5-thio-, 4470⁸.
- C₁₆H₁₁N₂S₂ 1,3,4-Thiodiazole, 2,2'-dithiobis[5- β -phenylhydrazino-, 1398¹.
- C₁₆H₁₁NI₂O₄ + 2H₂O Methyl nickelosalicylate, 829⁸.
- C₁₆H₁₁O γ -Brazan, 8,9,10,11-tetrahydro-, 2439⁹.
Chalcone, 4'-methyl-, 3685³.
Ether, methyl 2-methyl-9-anthryl-, 5183⁷.
1-Indanone, 5-methyl-3-phenyl-, 2706⁸.
—, 3-tolyl-, 2706^{8,7}.
Ketene, di-*p*-tolyl-, 2950⁹.
1(2)-Naphthalenone, 3,4-dihydro-3-phenyl-, 2710¹.
- C₁₆H₁₁O₂ Acenaphthene, diacetyl-, P 1137⁷, P 1417⁴.
Acid, m. 100-5 $^{\circ}$, from polyoric acid, 1128⁸.
Acrylic acid, β -phenyl- β -tolyl-, 2706^{8,4}.
 β -Butenic acid, γ , γ -diphenyl-, 5181².
Chalcone, β -methoxy-, 3683⁹.
Cinnamic acid, benzyl ester, 4508^{2,4}.
Phenanthrene, dimethoxy-, 3466¹, 4468⁹.
Phthalide, 2-(2,5-xylyl)-, 3915⁸.
p-Tolil, 3923¹.
- C₁₆H₁₁O₂ Cinnamic acid, *p*-methoxy-Ph ester, 2432¹.
Phenol, *p*-(allyloxy)-, benzoate, 2705⁷.
- C₁₆H₁₁O₄ *p*-Anisil, 3923².
p-Coumaric acid, α -*p*-hydroxybenzyl-, 1128⁹.
Flavanone, hydroxymethoxy-, 837¹.
9-Fluorenone, 1,4,6-trimethoxy-, 4168².
Isoflavanone, 3-hydroxy-7-methoxy-, 4702⁸.
Methyl ether, m. 105-8 $^{\circ}$, of compd. from chlorocodizone, 1644².
- C₁₆H₁₁O₂S Thioxanone, 6,6-bis(*p*-hydroxyphenyl)-, 1809⁹.
Thioxanone, 2,3,4-trimethoxy and salts, 3706⁴.
- C₁₆H₁₁O₂ (See also *Brasilin*.)
Isophyllodulcin, 2714⁷.
Isosakuranetin, 837¹, 2977⁸, 3475⁴.
Isovanillic acid, 2-*p*-tolyl-, 2174⁸.
Kikokunetin, 2717¹, 2977⁸.

- Phylloolulcin, 2714¹.
 Sakuranetin, 148⁹, 2956⁸.
C₁₆H₁₆O₈ (See also *Hematoxylin*.)
 Compd., m. 192-7°, from 2,4 - dihydroxy-acetophenone and AcC(:CHOEt)CO₂Et, 829⁸.
 Diphenic acid, dimethoxy-, 129⁸, 4469¹.
 Hesperetin, 148⁹, 2957¹.
 Homoiodictyol, 4210⁸.
 Syringic acid, benzoate, 2181¹.
C₁₆H₁₆O₇ Benzophenone, 2,4,4',6 - tetrahydroxy-, 4'-Et carbonate, 2162¹.
C₁₆H₁₆As₂N₂O₂ Benzenearsonic acid, *p* - (3 - amino - 2 - methyl - 4 - quinolylazo) -, and Na salt, 839^{1,2}.
C₁₆H₁₆Br₂N₂O₂ Indophenol, 2,6 - dibromo - 5' - isopropyl - 2' - methyl -, 3450⁸.
C₁₆H₁₆Cl₂N₂O Cinchoninamide, *N,N* - diallyl 2-chloro-, P 2127⁸.
 1 - (2 - Methyl - 3 - indylcarbonylmethyl) - pyridinium chloride, 4215⁸.
C₁₆H₁₆ClO Propionyl chloride, β - phenyl - β - tolyl-, 2706^{8,9,7}.
C₁₆H₁₆HgNO₃ Acetanilide, (acetoxymethyl) - phenyl-, 830^{8,7}.
C₁₆H₁₆I₂NO₂ Alanine, β - [4 - (*p* - hydroxyphenoxy) - 3,5 - diiodophenyl] -, Me ester, and HCl, 1631⁹, 1632¹.
C₁₆H₁₆N Indoline, 3 - styryl -, 1635⁸.
 Pseudoindole, 3,3 - dimethyl - 2 - phenyl -, 3927¹.
C₁₆H₁₆NO Aniline, *N* - *p* - methoxycinnamal -, 3911⁷.
 Compd., m. 34.2°, from *o*-cresol and quinoline, 122⁹.
 Compd., m. 31.8°, from *p* - cresol and quinoline, 123¹.
 Crotonamide, *N,N* - diphenyl -, 2697².
 1 - Indanone, 5 - methyl - 3 - phenyl -, oxime, 2708¹.
 —, 3 - tolyl-, oxime, 2706^{8,7}.
 Isocyanic acid, β,β' - diphenylisopropyl ester, 4470¹.
 1(2) - Naphthalenone, 3,4 - dihydro - 3 - phenyl-, oxime, 2710¹.
 Δ^2 - Oxazoline, 4 - methyl - 2,5 - diphenyl -, 3690¹.
 Tryptophol, α -phenyl-, 1635⁷.
C₁₆H₁₆NO₂ *o* - Acetotoluide, 5 - benzoyl -, 129⁸.
 Hydrocinnamonitrile, α - hydroxy - α - phenoxymethyl-, 4481¹.
 Phenol, *p* - (*p* - methoxycinnamalamino) -, 3911⁸.
 Phthalimidine, 2 - *m* - phenetyl -, 146⁷.
C₁₆H₁₆NO₂S Acetanilide, *o* - mercapto - *N* - methyl -, benzoate, 142¹.
C₁₆H₁₆NO₂ Alanine, benzoylphenyl-, 2195⁸.
 Anthraquinone, 5 - acetamido - 1,2,3,4 - tetrahydro-, P 2189⁸.
 1,3 - Butanedione, 2 - hydroxy - 1,2 - diphenyl -, 3 - oxime, 2974¹.
 Hydrocinnamic acid, benzamido-, 126¹, 1877¹.
 3 - Isophenoxazone, 4 - hydroxy - 2 - isopropyl - 5 - methyl -, 1895⁸.
 Mandelonitrile, α - [(*m* - anisylloxy)methyl] -, 4702⁸.
C₁₆H₁₆NO₂S Thianthrene, 6 - acetamido - 2,3 - dimethoxy -, 3468⁸.
C₁₆H₁₆NO₂ 2 - Quinolinesacetic acid, α - acetyl -, Et ester, 2182⁹.
 Tyrosine, benzoyl-, 2195⁸.
C₁₆H₁₆N₂ α - Tolunitrile, α - acetyl -, phenylhydrazone, 1126⁸.
 1,3,4 - Triazole, 2 - methyl - 5 - phenyl - 1 - tolyl-, 836¹.
C₁₆H₁₆N₂O 1 - Indanone, 4 - phenyl-, semicarbazone, 2710¹.
 Isobutaryl azide, β,β' - diphenyl -, 4470¹.
 Isoxazole, 3 - methyl - 5 - phenyl - 4 - β - phenylhydrazino-, 2974¹.
 Δ^2 - Isoxazoline, 5 - (*o* - aminophenyl) - 4 - imino - 3 - methyl - 5 - phenyl -, and compd. with SnCl₄, 2974^{8,5}.
 2,3 - Pyrroledione, 4,5 - dihydro - 4 - phenyl, monophenylhydrazone, 4463⁸.
C₁₆H₁₆N₂O₂S Spiro[acridan - 5,2' - thioxane] - 6' - one, 2,8 - diamino -, 1899⁸.
C₁₆H₁₆N₂O₄ Pyruvic acid, (*o* - nitrophenyl) -, methylphenylhydrazone, 4699⁸.
C₁₆H₁₆N₂O₅ Vanillin, *p* - nitrophenylhydrazone, acetate, 3675⁹.
C₁₆H₁₆N₂O₆ Apiolaldehyde, *p* - nitrophenylhydrazone, 598⁷.
C₁₆H₁₆N₂S Thiazole, 2 - amino - 5 - (aminotolyl) - 4 - phenyl -, and HCl, 1110⁸, and salt, 1410¹.
 Thiazole, phenyl(β - tolylhydrazino) -, 1410^{1,4}.
 Δ^4 - Thiazoline, 2 - imino - 4 - phenyl - 3 - *p* - toluino -, 1410⁸.
C₁₆H₁₆N₂O Benzimidazole, 1 - propyl-, picrate, 1638¹.
C₁₆H₁₆N₂S Urea, α - (5 - methyl - 1 - phenyl - 3 - 1,2,4 - triazolyl) - β phenylthio -, 1640².
C₁₆H₁₆N₂S₂ 5 - Triazole, 3 - (benzylmercapto) - 5 - (β - phenylthiocarbamido) -, 2178⁸.
 1,2,4 - Triazole, 5 - (methylmercapto) - 1 - phenyl - 3 - (β - phenylthiocarbamido) -, 2178².
C₁₆H₁₆N₂O₆ Guanidine, hippuryl-, picrate, 1621⁹.
C₁₆H₁₆ Butene, diphenyl-, 1397^{1,2}, 4465¹.
 Indan, 1 - *o* - tolyl -, 2706¹.
 Naphthalene, 1,2,3,4 - tetrahydro - 2 - phenyl -, 2710¹.
 Propene, 2 - methyl - 1,1 - diphenyl -, 3908¹.
 Stilbene, α,α' -dimethyl -, 385¹.
C₁₆H₁₆As₂N₂O₂ Acetanilide, *p,\beta'* - arsenobis-, 3677¹.
 Plasmomorpholine, 6,6' - arsenobis -, 842¹.
C₁₆H₁₆As₂N₂O₂ Acetic acid, α - β - [(carbamylmethyl)amino]phenylarseno]phenoxyl-, 119¹.
C₁₆H₁₆As₂N₂O₂S₂ Salicylaldehyde, arsenobis-, bisthiosemicarbazone, 1995¹.
C₁₆H₁₆BrNO₂ Benzyl alcohol, *p* - bromo - α - ethyl-, carbanilate, 2157⁸.
C₁₆H₁₆Br₂O₂S Thianthrene, 2,3,6,7 - tetramethoxy -, meriquinoid perbromide, 3467⁹.
C₁₆H₁₆ClNO Butane, chloronitrosodiphenyl-, 1397⁹.
C₁₆H₁₆ClO₂S Thianthrene, 2,3,6,7 - tetramethoxy -, meriquinoid chloride, 3467⁹.
C₁₆H₁₆ClO₂S₂ Thianthrene, 2,3,6,7 - tetramethoxy -, meriquinoid perchlorate, 3467⁹.
C₁₆H₁₆N₂O₂S Carbanilic acid, methylidithio -, anhydride with methylcarbarilic acid, 2953¹.
C₁₆H₁₆N₂O₂ Aniline, *N,N* - dimethyl - 5 - nitro - 2 - styryl -, 4700¹.
 Anisaldehyde, azine, 2662⁹.
 1 - (2 - Methyl - 3 - indylcarbonylmethyl) - pyridinium hydroxide, 4215⁸.

- 2,3 - Phenazinediol, 1 - isopropyl - 4 - methyl -, 1895⁹.
- C₁₆H₁₆N₂O₂S₂ Acetanilide, *o,o'* - dithiobis -, 142⁹.
- C₁₆H₁₆N₂O₂ Benzoic acid, 2 - methoxy - 5 - phenylazo -, Et ester, 4203⁹.
- C₁₆H₁₆N₂O₄ 6211¹.
- Benzamide, *N* - (β - hydroxy - α - methylphenethyl) - β - nitro -, 3689⁹, 3690¹.
- , *N* - (4 - methoxy - 3 - nitrophenethyl) -, 4705⁴.
- Benzyl alcohol, β - dimethylamino -, nitrobenzoate, 124¹.
- β,β' - Biacetanilide, 2,2'-dihydroxy -, 2161¹.
- Norephedrine, *N* - β - nitrobenzoyl -, 2705⁴.
- Norpseudoephedrine, β - nitrobenzoate, 2705⁴.
- , *N* - β - nitrobenzoyl -, 2705⁴.
- C₁₆H₁₆N₂O₂S₂ Sulfide, bis(4,5 - dimethoxy - 2 - nitrophenyl), 4204⁹.
- Veratrole, 4,4' - thiobis[5 - nitro -, 3468⁹.
- C₁₆H₁₆N₂O₂S₂ Disulfide, bis(4,5 - dimethoxy - 2 - nitrophenyl), 4204⁹.
- C₁₆H₁₆N₂S Benzylamine, *N* - ethyl - *N* - β - thiocyanophenyl -, 2245⁹.
- Carbanilide, β - isopropenylthio -, 4688⁴.
- C₁₆H₁₆N₂S₂ 1,1' - Bithionaphthene, 2,2' - diamino - 1,1',2,2' - tetrahydro -, and -HCl, 3468⁹.
- C₁₆H₁₆N₂S₂ Disulfide, bis(methylphenylthiocarbonyl), 1307⁴.
- C₁₆H₁₆N₂O₂S Pseudoourea, γ - methyl - α,β - bis(phenylcarbonyl)thio -, 3903⁴.
- C₁₆H₁₆N₂O₂S₂ 1,2,4 - Triazole, 5 - (methylmercapto) - 1 - phenyl - 3 - tolylsulfonamido -, 2179⁹.
- C₁₆H₁₆N₂S Cinnamaldehyde, 4 - anilinothiosemicarbazone, 140⁴.
- 1,3,4 - Thiadiazole, 2,5 - bis(*N* - methylanilino) -, 1900¹.
- * C₁₆H₁₆N₂O₂ Butyrakhyde, α - keto -, β - nitrophenylosazone, 4670⁷.
- C₁₆H₁₆O Anethole, γ - phenyl -, 2959⁹.
- Anisole, β - 1 - igdanyl -, 1130¹.
- Benzohydrol, α - allyl -, 1870³.
- Butyophenone, γ - phenyl -, 1395⁹.
- Estragole, γ - phenyl -, 2959⁹.
- Ethylene oxide, α - benzyl - α - methyl - β - phenyl -, 2958⁹.
- 2-Indanol, 2-tolyl -, 4213⁹.
- Propiophenone, β - β - tolyl -, 125⁴.
- C₁₆H₁₆O₂ 9 - Anthroic acid, 1,2,3,4 - tetrahydro-, Me ester, 4214⁹.
- 2 - Anthrol, 1,2,3,4 - tetrahydro -, acetate, 4694⁷.
- Cyclohexane, 1,2 - epoxy - 1 - (2 - naphthoxy) -, 2439⁹.
- Ethanol, 1,2 - diphenyl -, acetate, 124¹, 2179⁹.
- Propionic acid, β - phenyl - β - tolyl -, 2706⁴.
- C₁₆H₁₆O₂ Acetophenone, hydroxymethoxymethyl- α -phenyl -, 2180⁷.
- Ketone, anisyl 2-hydroxy-3,5-xylyl, P 2187⁹.
- Propiophenone, β - methoxy - β - salicyl -, 125⁴.
- C₁₆H₁₆O₄ 3,4 - Chromandiol, 7 - methoxy - 3 - phenyl -, 4702⁴.
- Propiophenone, 2,4 - dihydroxy - β - β - anisyl -, 836⁹.
- C₁₆H₁₆O₄ Thianthrene, 2,3,6,7 - tetramethoxy -, 3467⁹.
- C₁₆H₁₆O₄ Amino acid, 2 - (2,5 - dimethoxyphenyl) -, 4469⁹.
- Glycolic acid, *o* - anisyl - β - anisyl -, 832⁹.
- Mandelic acid, α - [(*m* - anisyoxy)methyl] -, 4702⁴.
- Phloropropiophenone, β - β -anisyl -, 837¹.
- C₁₆H₁₆O₂ Thianthrene, 2,3,6,7 - tetramethoxy-, 9 - oxide, 3467⁹.
- C₁₆H₁₆O₄ 1,2 - Benzopyran - 3 - carboxylic acid, acetylethyl - 5 - hydroxy - 2 - keto -, Et ester, 3219⁷.
- γ - Pentenic acid, α - acetyl - β - keto - δ - (3,4 - methylenedioxyphenyl) -, Et ester, 4211⁷.
- C₁₆H₁₆O₂ Benzoic acid, *o* - (2,5 - dimethoxyphenylsulfonyl) -, Me ester, 1901⁴.
- C₁₆H₁₆O₂ Thianthrene, 2,3,6,7 - tetramethoxy-, dioxide, 3467⁹.
- C₁₆H₁₆O₂ Thianthrene, 2,3,6,7 - tetramethoxy-, 9,9,10-trioxide, 3467⁹.
- C₁₆H₁₆O₂S Resorcinol, trimercapto -, pentaacetate, 826¹.
- C₁₆H₁₆O₄ Δ^1 - 2,4 - Hexenedione, 6 - (2,5 - dihydroxyphenyl) -, bis(methylcarbonate), 4211⁴.
- C₁₆H₁₆O₂S Thianthrene, 2,3,6,7 - tetramethoxy-, 9,9,10,10-tetroxide, 3467⁹.
- C₁₆H₁₆As₂NO₂ Acetic acid, [β - [β - (β - hydroxyethylamino)phenylarsenol]phenoxy] -, 119⁴.
- C₁₆H₁₆As₂N₂O₂ Glycine, *N* - [β - [β - [(carbamylmethyl)amino]phenylarsenol]phenyl] -, di - HCl, 119⁴.
- C₁₆H₁₆As₂N₂O₂ Glycine, *N* - [β - [β - [(carbamylmethyl)amino]phenyldiarsenol]phenyl] -, 119⁴.
- C₁₆H₁₆Br Propane, 3 - bromo - 1 - phenyl - 1 - β - tolyl -, 2709⁹.
- C₁₆H₁₆BrN₂O₂ *m* - Bromobenzyltrimethylammonium picrate, 2951⁴.
- C₁₆H₁₆ClN₂ Camphanoquinoxaline, 7(or 8) - chloro-, 2189⁹.
- C₁₆H₁₆ClN₂O₂ 5 - Amino - 2,8 - dimethoxy - 10 - methylacridinium chloride, 1904⁴.
- C₁₆H₁₆IN₂ Benzylethylbenzimidazolium iodide, 1637⁷.
- C₁₆H₁₆N Aniline, *N*, *N* - dimethyl - β - (α - methylenebenzyl) -, and -HCl, 4689³.
- Indoline, 3,3 - dimethyl - 2 - phenyl -, and salts, 3927⁷.
- Pyrrolidine, 3,4 - diphenyl -, 1634¹.
- Quinoline, 1,2,3,4 - tetrahydromethyl - 2 - phenyl -, and salts, 3927⁷.
- C₁₆H₁₆NO Acetamide, *N* - (tetrahydroanthryl) -, 4695².
- Butyophenone, γ - phenyl -, oxime, 1396⁹.
- β - Phenetidine, *N* - benzal - 2 - methyl -, 1888⁹.
- Quinoline, 2 - β - anisyl - 1,2,3,4 - tetrahydro-, and salts, 3927⁷.
- C₁₆H₁₆NO₂ Benzamide, *N* - (β - hydroxy - α - methylphenethyl) -, 3690¹.
- Benzyl alcohol, β - dimethylamino -, benzoate, 124¹.
- Indophenol, isopropylmethyl-, 3450⁴.
- Isobutyric acid, β - amino - β,β' - diphenyl -, -HCl, 1893¹.
- Norpseudoephedrine, benzoate, -HCl, 2705⁴.
- , *N* - benzoyl -, 2705⁴.
- Δ^1 - 2 - Pentenol, 1 - naphthalene-carbamate, 1876⁹.
- β - Phenetidine, 2 - methyl - *N* - salicylal -, 1888⁹.
- 1 - Propanol, 1 - phenyl - 2 - (benzylideneoximino) -, 4209⁹.
- α - Toluo - β - phenetide, 2245⁴.

- $C_{10}H_{11}NO_3$ Isoindoline, 1 - methyl - 2 - *p* - tolylsulfonyl-, 2176².
- $C_{10}H_{11}NO_3$ Benzyl alcohol, α - (α - hydroxaminoethyl)-, benzoate, 4205².
- Bibenzyl, α - methoxy - *m* (and *p*) - methyl - α' - nitro -, 2709^{2,3}.
- Cyclohexenecarboxylic acid, β ethylidene-phenylcarbamyl-, 2674⁷.
- 1 - Propanol 1 - phenyl - 2 - (*o* - hydroxybenzylideneoximino)-, 4205⁴.
- p* - Salicylophenetide, 2' - methyl -, 1888².
- $C_{10}H_{11}NO_3$ 2 - Butanone, 4 - phenyl -, oxime, benzenesulfonate, 1895².
- $C_{10}H_{11}NO_3$ Compd., m. 64-6°, from anthranilaldehyde and di-Et β -ketoglutarate, 4218⁸.
- Mandelamide, α - [*m* - anisoyloxy)methyl]-, 4702⁸.
- Norlaudanosine, 1883⁷.
- 1 - Propanol, 1 - phenyl - 2 - (3,4 - dihydroxybenzylideneoximino)-, 4205⁴.
- $C_{10}H_{11}NO_3$ Sulfilimine, *S* - (*m* - carboxyphenyl)-*S* - ethyl - *N* - *p* - tolylsulfonyl -, 824⁹.
- $C_{10}H_{11}NO_3$ Isoserine, β - phenyl - *N* - *p* - tolylsulfonyl-, 4684⁷.
- $C_{10}H_{11}N_2O$ Acetophenone, δ - benzylsemicarbazone, 3903⁷.
- Acetotoluide, tolylazo-, 3542⁴.
- Propiophenone, β - phenyl -, semicarbazone, 121⁴.
- $C_{10}H_{11}N_2O_2$ Acetanilide, α, α' - iminobis -, 1112⁸.
- Camphanoquinoxaline, 7(or 8) - nitro -, 2169¹.
- Hydrazine, β - acetyl - α - phenyl - α - *N* - phenylglycyl-, 145⁷.
- 2 - Propanone, 1 - phenoxy - 3 - phenyl -, semicarbazone, 4481².
- $C_{10}H_{11}N_2O_2$ Benzoin, methoxy-, semicarbazone, 4687^{2,3}.
- 1 - Phthalazineacetic acid, 2 - (*m* - aminophenyl) - 1, 2, 3, 4 - tetrahydro - 4 - hydroxy-, 146¹.
- $C_{10}H_{11}N_2O_2$ Acetophenone, 4 - hydroxy - 3,5 - dimethoxy -, *p* - nitrophenylhydrazon-, 3452².
- $C_{10}H_{11}N_2O_2$ Urea, α - phenyl - α - propyl -, picrate, 3442².
- $C_{10}H_{11}O_3$ Thianthrene, 2,3,6,7 - tetramethoxy-, meriquinoid sulfate, 3467².
- $C_{10}H_{11}$ Naphthalene, cyclohexyl-, 1936².
- $C_{10}H_{11}AsN_2O_3$ Benzenearsonic acid, 3 - acetamido - 4 - (*p* - acetamidooaniline)-, 2951⁴.
- $C_{10}H_{11}AsN_2O_3$ Glycine, *N* - [*p* - [*p* - (β - hydroxyethylamino)phenylarsenol]phenyl]-, di - HCl, 119².
- $C_{10}H_{11}BrNO_2$ Camphorimide, *N* - (*p* - bromophenyl)-, 129².
- $C_{10}H_{11}Br_2N_2O_2$ Phenetole, *o, o'* - hydrazobis-[5-bromo-, 4456².
- $C_{10}H_{11}Br_2N_2O$ Isopyrrole, 4 - acetyl - 2 - [(3,5 - dibromo - 4 - ethyl - 2 - pyrrol)methylene] - 3 - ethyl - δ - methyl -, perbromide, -HBr, 2184¹.
- $C_{10}H_{11}ClNO_2$ 1 - Pentanol, δ - chloro-, 1 - naphthalenecarbamate, 2423².
- $C_{10}H_{11}ClN_2S$ See *Methylene blue*.
- $C_{10}H_{11}CoK_2N_2O_4 + 2H_2O$, 1361¹⁰.
- $C_{10}H_{11}HgN_2O_4$ Caffeine, 8,8' - mercuribis -, 1622².
- $C_{10}H_{11}INO_2$ Camphorimide, *N* - (iodophenyl)-, 129².
- $C_{10}H_{11}N_2$ Camphanoquinoxaline, 2169¹.
- $C_{10}H_{11}N_2O_2$ *m* - Cresol, 4 - (2 - methyl - *p* - phenetylazo)-, 1888⁴.
- 3 - Indazolecarboxylic acid, 2 - benzyl - 4,5,6,7 - tetrahydromethyl-, 2972^{2,4}.
- , 4,5,6,7 - tetrahydro - 4,6 - dimethyl - 2 - phenyl-, 2972².
- 3 - Isoindazolecarboxylic acid, 1 - benzyl - 4,5,6,7 - tetrahydro-, Me ester, 2971¹⁰.
- , 1 - benzyl - 4,5,6,7 - tetrahydromethyl-, 2972^{2,4}.
- , 4,5,6,7 - tetrahydro - 4,6 - dimethyl - 1 - phenyl-, 2972².
- , 4,5,6,7 - tetrahydromethyl - 1 - phenyl -, Me ester, 2972^{2,4}.
- $C_{10}H_{11}N_2O_3$ Urea, thio - α - tolyl - β - vanillyl -, 3452⁴.
- $C_{10}H_{11}N_2O_3$ 7 - Imidazolecarboxylic acid, 3,3a,4,5,6,7 - hexahydro - 3 - keto - 2 - phenyl-, Et ester, 4678².
- Phenetole, azoxybis -, 25², 1031², 1793⁴, 2662².
- $C_{10}H_{11}N_2O_4$ 9 - Carbazolecarboxylic acid, 1,2,3,4 - tetrahydro - 3 - methylnitro -, Et ester, 139².
- $C_{10}H_{11}N_2O_4$ Glycine, *N* - (*N* - phthalyleucyl)-, 138¹⁰.
- $C_{10}H_{11}N_2O_5$ Alanine, *N* - (*N* - 2 - naphthylsulfonyldanyl)-, 1619⁴.
- Butyric acid, α - [*N* - (2 - naphthylsulfonylglycylamino)-], 2993¹.
- Glycine, *N* - [α - (2 - naphthylsulfonamido)-butyryl]-, 2993¹.
- $C_{10}H_{11}N_2S$ Carbamide, 2,2',4 - trimethylthio-, 3445².
- $C_{10}H_{11}N_2O_7$ Benzyltrimethylammonium picrate, 2117².
- $C_{10}H_{11}N_2O_8$ 3 - Pyrrolepropionic acid, 4 - ethyl - 3 - methyl -, picrate, 1133².
- $C_{10}H_{11}N_2O_{11}$ 2,3 - Butanediamine, dipicrate, 3663¹.
- $C_{10}H_{11}O$ Benzyl alcohol, α - (γ - phenylpropyl) -, 1396².
- 2 - Butanol, 2,4 - diphenyl - 1397².
- Phenethyl ether, 4681².
- 1 - Propanol, 3 - phenyl - 3 - *p* - tolyl -, 2706².
- $C_{10}H_{11}O_2$ Ethane, 1,2 - bis(benzoyloxy)-, P 3931⁵.
- Methane, (benzoyloxy)phenethyloxy-, 1871⁹.
- , phenethyloxy - *o* - toloxy-, 1871⁹.
- , phenoxy(γ - phenylpropoxy)-, 1871⁹.
- Phenyl, butylidenebis -, 4683⁹.
- $C_{10}H_{11}O_2$ Ethane, *s* - bis(benzylsulfinyl) -, 4202².
- Ethane, *s* - bis(*p* - tolylsulfinyl)-, 4202².
- $C_{10}H_{11}O_2$ Methane, (*o* - anisoyloxy)phenethyloxy-, 1871⁹.
- $C_{10}H_{11}O_2$ 2 - Naphthol, 3,6,8 - tris(methylmercapto)-, Et carbonate, 1129⁵.
- $C_{10}H_{11}O_2$ Veratrole, 4,4' - dithiobis -, 3467².
- $C_{10}H_{11}O_2$ 1,2 - Benzopyran - 3 - carboxylic acid, 6,8 - diethyl - 5 - hydroxy - 2 - keto -, Et ester, 3219².
- Levulinic acid, α, α, β - trimethylpiperonylidene -, 111¹.
- Methystenic acid, dihydro-, Me ester, 2965².
- $C_{10}H_{11}O_2$ Scopoletin, glucoside, 600².
- $C_{10}H_{11}O_{10}$ Fraxin, 2718⁹.
- $C_{10}H_{11}As_2N_2O_3$ Arsenobenzene - 4' - glycine - amide - *N* - dimethylenesulfoxylic acid, 4 amino -, 119².
- $C_{10}H_{11}Br_2N_2O$ 4 - Isopyrrolepropionic acid, 2 - 3,5 - dimethyl - 2 - pyrrol(methylene) - 3,5 - dimethyl - bromine deriv., 5191².
- $C_{10}H_{11}ClN_2O$ Cinchonamide, 2 - chloro - *N, N* - dipropyl -, P 1217².

- C₁₈H₁₉ClN₂O₂** Cinchoninic acid, 2 - chloro -, diethylaminoethyl ester, P 1995⁹.
- C₁₈H₁₉ClN₂O₂** *p* - Formylphenyltrimethylammonium chloride, *p* - nitrophenylhydrazine, 2429⁹.
- C₁₈H₁₉NO** Benzyl alcohol, α - (α - benzylaminoethyl)-, 4205⁹; and - *HCl*, 3454⁹.
- C₁₈H₁₉NO₂** Benzyl alcohol, α - [α - (*o* - hydroxybenzylamino)ethyl]-, 4205⁹.
- 9 - Carbazolecaboxylic acid, 1, 2, 3, 4 - tetrahydro - 3 - methyl-, Et ester, 139⁹.
- 2 - Pentanol, 1 - naphthalene carbamate, 1876⁹.
- Spiro[cyclohexane - 1, 3' - pyrrolidine]⁹ - 5' - one, 1' - benzoyl-, 819².
- C₁₈H₁₉NO₃** Benzyl alcohol, α - [α - (3, 4 - dihydroxybenzylamino)ethyl]-, 4205⁹.
- C₁₈H₁₉NO₃** 3 - Indolepropionic acid, 2 - carboxy-, di-Et ester, 834⁹.
- C₁₈H₁₉NO₄** 4 - Morpholineacetic acid, 2, 6 - diketone - α , α , 3, 3 - tetramethyl - 5 - phenyl-, 102⁹.
- C₁₈H₁₉NO₄** Malonic acid, [(3, 4 - methylenedioxypheyl) - 1 - piperidylmethyl]-, 1892⁹.
- C₁₈H₁₉N₃** Aniline, *N*, *N* - diethyl - *p* - phenylazo-, 4200⁹.
- Camphanoquinoxaline, 7(or 8) - amino -, 2169¹.
- C₁₈H₁₉N₃O₂S** Benzenesulfonic acid, *p* - (*p* - diethylaminophenylazo) -, *N* a salt, 4201⁹.
- Benzenesulfonic acid, (dimethylaminotolylazo)-, Me ester, 4201⁹.
- C₁₈H₁₉N₃O₄** Barbituric acid, 5, 5 - diethyl - 1 - methyl - 3 - *p* - nitrobenzyl-, 821⁹.
- Δ^2 - 4, 5 - Pyrazolinedicarboxylic acid, 4, 5 - dimethyl - 1 - phenylcarbonyl -, di - Me ester, 3705².
- C₁₈H₁₉N₃O₇** Hydrazine, carvacryl -, picrate, 5470⁹.
- C₁₈H₁₉N₃O₈** Camphidone, imino-, picrate, 2966⁹.
- C₁₈H₁₉N₃O₈** Bornylene, phenyl-, 1406⁹.
- C₁₈H₁₉BrN₂O₂** Camphoranic acid, bromo-, 129⁹.
- C₁₈H₁₉Br₂N₂O₂** 4 - Isopyrrolepropionic acid, 2 - (3, 5 - dimethyl - 2 - pyrrolmethylene) - 3, 5 - dimethyl -, bromine deriv., 5191².
- C₁₈H₁₉ClNO₂** Camphoranic acid, 2' - chloro -, 129⁹.
- C₁₈H₁₉Cl₂N₂Te** Bis(*p* - dimethylaminophenyl)-tellurium dichloride, 3678².
- C₁₈H₁₉HgN₂** Aniline, *p*, *p'* - mercuribis[*N*, *N* - dimethyl-, 1889².
- C₁₈H₁₉INO₂** Camphoranic acid, iodo-, 129⁹.
- C₁₈H₁₉I₂N₂Te** Bis(*p* - dimethylaminophenyl)-tellurium diiodide, 3678².
- C₁₈H₁₉N₂** Aniline, *p*, *p'* - α - methylpropyldenebis-, 4688⁹.
- C₁₈H₁₉N₂NO₂** Methyl diammonemeclosalicylate, 829⁹.
- C₁₈H₁₉N₂O₂** Cinchoninamide, 2 - ethoxy - *N*, *N* - diethyl-, P 1217⁹.
- 4 - Isopyrrolepropionic acid, 2 - (3, 5 - dimethyl - 2 - pyrrolmethylene) - 3, 5 - dimethyl-, and - *HBr*, 5191².
- C₁₈H₁₉N₂O₂S** *p* - Phenetidine, 2, 2' - dithiois-, 2245².
- C₁₈H₁₉N₂O₃** Acid, m. 304° (decomn.), from oxidation of vomine, 3474⁹, 3475⁹.
- Barbituric acid, 5 - butyl - 5 - ethyl - 1 - phenyl -, 3024¹.
- , 5 - ethyl - 5 - isobutyl - 1 - phenyl -, 3024¹.
- Cinchonic acid, 2 - hydroxy-, diethylaminoethyl ester, P 1995⁹.
- C₁₈H₁₉N₂O₂S** Hydrocinflamamidine, *p* - toluene-sulfonate, 1895⁹.
- C₁₈H₁₉N₂O₄** Acid, m. 311°, from oxidation of brucine, and salts, 3474⁹.
- Barbituric acid, 5, 5 - diethyl - 1 - *p* - phenetyl-, 3024¹.
- 4 - Piperitone, 2, 2, 6 - trimethyl - 1 - (2 - nitro-*p*-tolyl)-, 2935².
- C₁₈H₁₉N₂O₄S** Aniline, 2, 2' - thiois[4, 5 - dimethoxy-, 3468².
- C₁₈H₁₉N₂O₅** 2, 3, 5, 6 - Pyrazinetetracarboxylic acid, tetra - Et ester, 3473².
- C₁₈H₁₉N₂Te** Aniline, *p*, *p'* - tellurobis[*N*, *N* - dimethyl-, 3678².
- C₁₈H₁₉N₂** Camphanoquinoxaline, diamino -, 2169¹, 2170¹.
- Guanidine, (*p* - dimethylaminophenyl) - *o*-tolyl-, P 5475⁹.
- C₁₈H₁₉N₂O₃** *p* - Formylphenyltrimethylammonium hydroxide, *p*-nitrophenylhydrazine, 2429⁹.
- C₁₈H₁₉N₂O₃S** Piperonyl alcohol, α - *p* - toluene - acid sulfite, guanidine salt, 5171⁹.
- C₁₈H₁₉O** Enanthaldehyde, α - cinnamal, P 371⁹.
- C₁₈H₁₉O₂** Camphor, phenylhydroxy -, 1405⁹.
- Dicyclopentadienebenzoquinone, tetrahydro -, 1623⁹.
- C₁₈H₁₉O₂** Δ^2 - 4 - Heptenone, 5, 5 - dimethyl - 1 - (3, 4 - methylenedioxypheyl)-, 4942².
- C₁₈H₁₉O₂** Begenin, dimethyl -, 3690⁹.
- C₁₈H₁₉As₂N₂O₂S** Acetic acid, (4 - arsono - 2, 6 - diacetamidophenoxy) -, thioarsinite with HSCl₂CONH₂, 3678².
- 1, 4 - Benzoxazine - 6 - thioarsonous acid, 8 - acetamido - 3 - hydroxy -, di *p* - carboxy - β - amino ethyl ester, 3677².
- C₁₈H₁₉ClHgO₂** Terephthalic acid, 2 - (chloro-mercuro-), di Bu ester, 4943².
- C₁₈H₁₉ClO₄** Glucose, 5 - benzoyl - 1 - chloro - 2, 3, 6 - trimethyl -, 1119⁹.
- C₁₈H₁₉Cl₂N₂O₂** Copral, 1406⁹.
- C₁₈H₁₉IN₂** Benzylethyl - 4, 5, 6, 7 - tetrahydroindazolium iodide, 2972⁹.
- Benzyl - 4, 5, 6, 7 - tetrahydrodimethylindazolium iodide, 2972⁹.
- C₁₈H₁₉N** Compd., b.p. 140°, from aniline and camphor, 4690².
- C₁₈H₁₉NO** Acetamide, *N* - (octahydroanthryl -, 4695².
- α - Fenchenylnanamide, 3693⁹.
- C₁₈H₁₉NO₂** Dicyclopentadienebenzoquinone, tetrahydro -, oxime, 1623⁹.
- C₁₈H₁₉NO₃** (See also *Homatropine*.)
- Camphoranic acid, 129⁹.
- Cyclopentanecetic acid, 1 - *p* - tolylcarbonyl -, Me ester, 110⁹.
- C₁₈H₁₉NO₂S** 3 - Camphorsulfonanilide, 1887⁹.
- C₁₈H₁₉NO₃** 9 - Carbazolecaboxylic acid, 1, 2, 3, 4, 4a, 9a - hexahydro - 4a, 9a - dihydroxy - 3 - methyl -, Et ester, 139⁹.
- Cinnamic acid, 3, 4 - methylenedioxy - β - diethylaminoethyl ester, - *HCl*, 2199⁹.
- Nipecotic acid, 4 - hydroxy - 2, 6 - dimethyl -, Me ester, benzoate, P 1143⁹.
- C₁₈H₁₉NO₄** Malonic acid, (α - aminopropionylmethyl-, di-Et ester, - *HCl*, 1892⁹.
- C₁₈H₁₉NO₅** Ephedrine, 3, 4 - dihydroxy - 3, 4 - diacetate, oxalate, 5182².
- C₁₈H₁₉N₂O₃** Glycine, *N* - [N - (N - benzoyldihydroxyethyl)-, 1619¹.
- C₁₈H₁₉** Naphthalene, cyclohexyl - 1, 2, 3, 4 - tetrahydro-, 4939⁹.
- C₁₈H₁₇Cl₃NO₂** Ethanol, 2 - trichloro - 1 - (*o*-

- (dimethylamino)methyl) - α - methylpropoxyl -, benzoate, -HCl, 3742.
- C₁₆H₂₇NO₅** 44191.
- C₁₆H₂₇N₂O₂** Acetamide, *N*, *N'* - (4 - cyclohexyl *m* - phenylene)bis-, 29478.
- Camphoronehydroxylamine, benzal, oxime, 4209.
- Cycloheptanone, 2,2 - dimethyl -, oxime, carbanilate, 2702.
- C₁₆H₂₇N₂O₄** Nipecotic acid, hydroxyethyl-, methyl ester, -HCl, P 4777.
- 2 - Piperidineethanol, 1 - ethyl -, *p* - nitrobenzoate, -HCl, 19025.
- 4 - Piperidinol, 1 - butyl -, *p* - nitrobenzoate, -HCl, 19028.
- C₁₆H₂₇N₂O₅** 1 - Piperidinepropanol, β - methoxy-, *p* - nitrobenzoate, -HCl, P 3234.
- C₁₆H₂₇N₂O₄** 4 - Heptanol, 3,3 - dimethyl -, 3,5 - dinitrobenzoate, 24207.
- C₁₆H₂₇N₂O₃S** Benzyl alcohol, *p* - methyl - α - *p* - toluino, acid sulfite, gumidine salt, 51714.
- C₁₆H₂₇N₂O₄** Acetunilide, α - [N - (N - butyl) glycidylglycyl]amino-, 29921.
- C₁₆H₂₇N₂O₅** Glycine, *N* - α - (N - phenylcarbamylalanylaminobutyl), 1112.
- Glycine, *N* - [N - (N - phenylcarbamylglycidylvalyl), 1619].
- , *N* - [N - (N - phenylcarbamylglycidylglycidyl), 1619].
- C₁₆H₂₇N₂O₆** Norcamphane, 2 - (dimethylamino methyl)-, picrate, 36923.
- C₁₆H₂₇N₂O₄** Alloxantin, dimethylidopropyl, 51657.
- C₁₆H₂₇N₂O₄** 2,4 - Heptenedione, 6 - methyl -, Ni deriv., P 6065.
- C₁₆H₂₇O₃** Borneol, phenyl, 1106.
- Δ^2 - 2 - Butenone, 4 - (disopropylidene), P 1649.
- Compd., bp 189-90°, from α - pinene oxide, 41642.
- Δ^2 - 3 - Decenone, 1 - phenyl -, 3694.
- Δ^2 - 3 - Hexenone, 1 - cumenyl-3 methyl-, 3696.
- C₁₆H₂₇O** Cyclohexanone, 4 - β - methoxy - α , α - dimethylbenzyl-, 4689.
- Δ^2 - 3 - Nonenone, 1 - *p* - amyl -, 3696.
- C₁₆H₂₇O₃S** Benzenesulfonic acid, formyl ester, 1281.
- Borneol, benzenesulfonate, 121.
- C₁₆H₂₇O₄** Propionic acid, β , β' - phenylbenzyl-, di Et ester, 1371, 1381.
- Pyrocatechol, disuccinate, 2161.
- C₁₆H₂₇O₅** Adipic acid, β - (*p* - methoxy - α , α - dimethylbenzyl-, 4689).
- Phthalic acid, Bu β - ethoxyethyl ester, P 2187.
- C₁₆H₂₇O₆** Glucoside, dimethylbenzal - β - methyl-, 1091.
- Phthalic acid, bis(β - ethoxyethyl ester, P 2187).
- C₁₆H₂₇O₁₀S** Glucothiose, pentaacetyl-, 49321.
- C₁₆H₂₇O₁₁** Galactose, pentaacetyl-, 49331.
- Glucose, pentaacetate, 39039.
- pentaacetyl-, 8213, 29421.
- Glycolaldehyde, glucoside tetraacetate, 39021.
- C₁₆H₂₇N₃** Isopyrazole, 4,4 - diethyl - 3,5 - dimethyl -, benzyl iodide deriv., 47009.
- C₁₆H₂₇NO** Camphor, 3 - (2,5 - dimethyl - 1 - pyrryl) -, 29611.
- C₁₆H₂₇NO₂** 1 - Piperidineethanol, α ,3 - dimethyl -, benzoate, -HCl, 6021.
- 1 - Piperidinol, 1 - butyl -, benzoate, -HCl, 19025.
- C₁₆H₂₇NO₄** Malonic acid, (α - aminobenzyl)-ethyl-, di - Et ester, -HCl, 18022.
- C₁₆H₂₇NO₃S** Menthol, *p* - nitrobenzenesulfonate, 8309.
- C₁₆H₂₇NO₁₆** *d* - Glucose, 1 - amino -, pentaacetate, 16261.
- C₁₆H₂₇NO** Acetophenone, *p* - 3 - methylcyclohexyl, semicarbazone, 46909.
- C₁₆H₂₇NO₂** β - Alanine, *N* - (N-phenylcarbamyl)-leucyl-, 11139.
- C₁₆H₂₇** Cymene, cyclohexyl, 49369.
- Menthane, phenyl, 49372.
- C₁₆H₂₇IN** Trimethyl *p* - methylcyclohexenyl-phenylammonium iodide, 46881.
- C₁₆H₂₇N₃** β Octenaldehyde, β , β' - dimethyl -, phenylhydrazone, 16144.
- C₁₆H₂₇NO₂** 2 Piperidineethanol, 1 ethyl -, *p* - aminobenzoate, -HCl, 19028.
- 1 Piperidinol, 1-butyl -, *p* - aminobenzoate, -HCl, 19028.
- C₁₆H₂₇NO₃** Barbituric acid, 5,5 - diallyl 1,3 - di-propyl, 8211.
- Δ^2 - Cyclohexeneacetic acid, 6-6-amino
- Δ^2 - cyclohexeneacetic acid, 6-6-amino
- *Et* ester, and *Et* -HCl, 29581.
- 1-Piperidinepropanol, β -methoxy-, *p*-amino-benzoate, P 3234.
- C₁₆H₂₇NO₄** 1 - Propanol, 3 - diethylamino - 2 - ethoxy-, *p*-nitrobenzoate, -HCl, P 3234.
- C₁₆H₂₇NO** Homolevulinamide, *N*, *N*-diethyl -, *p* - nitrophenylhydrazon, 41909.
- C₁₆H₂₇NO** Cyclohexylamine, *N* *sc* butyl, picrate, 111.
- C₁₆H₂₇NO₃** (Ethoxyformylmethyl)triethylammonium picrate, 21507.
- C₁₆H₂₇O** Carvacrol, cyclohexyl-, 49372.
- Compd., bp 150°, from an amyl naph-thenol, 4155.
- Ether, butyl *or* and *p*-cyclohexylphenyl, 49372.
- Carvacryl cyclohexyl-, 49372.
- C₁₆H₂₇O** Compd., bp 235-30°, from butylidene-bisphenol, 16001.
- Cyclohexanol, 1 - (*p* - methoxy - α , α - di-methylbenzyl-, 16009).
- C₁₆H₂₇O₃S** Benzenesulfonic acid, methyl ester, 1281.
- C₁₆H₂₇O₅** Camphogluconic acid, *p*-hydroxy-, 42086.
- C₁₆H₂₇O₆** Fructose, tetraacetyl γ -ethyl, 21267.
- Glucose, tetraacetyl- β -ethyl, 1881.
- C₁₆H₂₇AsNO₄** 1 Propanecarboxylic acid, 3 *N*-hexyl-*m* nitrobenzamide, 929.
- C₁₆H₂₇HgNO** Aniline, *p*-acetoxymercuri)-*N*, *N* dibutyl-, 18889.
- C₁₆H₂₇NO** Camphor, 3 (2,5 dihydro 2,5-di-methyl 1 pyrryl), salts, 29611.
- C₁₆H₂₇NO₂** 1-Propanol, 1 phenyl 2-heptylidene-oximinol, 42057.
- C₁₆H₂₇NO₄** Glucosidyl dimethylamide, tetraacetyl-, -HCl, 41509.
- C₁₆H₂₇NO** Homolevulinamide, *N*, *N*-diethyl -, phenylhydrazon, 41909.
- C₁₆H₂₇BrN₂** Sparteine, compd with BrCN, 51881.
- Sparteine cyanamide, bromo-, and derivatives, 51879, 51881.
- C₁₆H₂₇BrN₂O** Glycine, α bromoisopropyltetra-cetyl-, 371, 4389.
- C₁₆H₂₇BrO** Itracetic acid, hexabromo-, 50531.
- C₁₆H₂₇NO** *H*-cholesterol, see *Alcyon*.
- C₁₆H₂₇NO** 1 Propanol, 3 - diethylamino - 2 - ethoxy-, *p* - aminobenzoate, -HCl, P 3234.

- C₁₆H₂₆N₂O₆ δ - Gluconolactone, 2,3,4,6 - tetramethyl-, phenylhydrazide, 2423⁷.
δ-Mannonolactone, 2,3,4,6-tetramethyl-, phenylhydrazide, 2423⁷.
- C₁₆H₂₆N₄O₈ Hexamethylenetetramine, thymol deriv., 4188⁹.
- C₁₆H₂₆N₄O₈ Hexamethylenetetramine, thymol-sulfonate, 4189¹.
- C₁₆H₂₆O₇ Hiragonic acid, 5053⁴.
- C₁₆H₂₆O₈ Phthalic acid, cyclohexyl Et ester, P 1138³.
- C₁₆H₂₆O₈ Cyclohexanemalonic acid, 1-acetonyl-, di-Et ester, 3672⁷.
- C₁₆H₂₆O₇ Borneolglucuronic acid, 1669⁴.
Glucoside, hydroxycamphor-, 4208⁹.
- C₁₆H₂₇AsN₂O₃ 1-Propanearsonic acid, 3-(α -hexyl- β -phenylcarbamido)-, 92⁴.
- C₁₆H₂₇BrO₂ Isovaleric acid, α -bromo- α -methyl-, ester with borneol, 4194⁷.
- C₁₆H₂₇NO Benzyl alcohol, α -(α -heptylaminoethyl)-, and salts, 4205³.
- C₁₆H₂₇N₃ Sparteine cyanamide, and aurate, 5188^{1,2}.
- C₁₆H₂₇N₃O₃ Cyclopentanemalonic acid, 1-acetonyl-, di-Et ester, semicarbazone, 3673¹.
- C₁₆H₂₇P Phosphine, bis(β -methylbutyl)phenyl-, and HgCl₂ compd., 4442⁴.
Phosphine, diamylphenyl-, and HgCl₂ compd., 4442⁴.
—, diisomylphenyl-, and HgCl₂ compd., 4442⁴.
- C₁₆H₂₇BrN₂O₃ Glycine, N-[N-(N-(α -bromoisocaproyl)glycyl)leucyl]-, 1113⁴.
Glycine, N-[N-(N-(α -bromoisocaproyl)leucyl)glycyl]-, 4192³.
Leucine, N-[N-(N-(α -bromoisocaproyl)glycyl)glycyl]-, 1213⁴.
- C₁₆H₂₇BrP Tripropyl-*p*-tolylphosphonium bromide, 4442¹.
- C₁₆H₂₇CuN₃S₄, 4420⁴.
- C₁₆H₂₇IP Dibutyl-*tert*-butylphenylphosphonium iodide, 2150⁴.
Dibutylmethyl-*p*-tolylphosphonium iodide, 2150⁴.
Diisobutylmethyl-*p*-tolylphosphonium iodide, 4442¹.
- C₁₆H₂₈N₂O₈ Cyclohexanecarboxylic acid, 2-(2-amino-cyclohexylcarbonylamino)- β Et ester, and its *h* HCl, 2958³.
- C₁₆H₂₈N₂O₇ Glycine, N[N₂ N-(N-(N-leucylglycyl)glycyl)glycyl]-, 1388⁹.
- C₁₆H₂₈N₁₀NiS₄, 4420⁴.
- C₁₆H₂₈O₂ See *Hydnocarpic acid*.
- C₁₆H₂₈O₃ Cyclohexanediol, diisovalerate, 4677²; divalate, 4677¹.
- C₁₆H₂₈O₄ Galactoside, β -*d*-bornyl-, 5167⁹.
- C₁₆H₂₈O₇ Mentholglucuronic acid, 1669⁴.
- C₁₆H₂₈BrN₂O₃ Butyric acid, β -(N- α -bromoisocaproyleucyl)aminol-, 1389¹.
- C₁₆H₂₈BrO₂ Isovaleric acid, α -bromo- α -methyl-, ester with menthol, 4194⁷.
- C₁₆H₂₈HgO₂ 1-Dodecene, Hg(OAc)₂ compd., 3899¹.
- C₁₆H₂₈NO Camphor, oxime, diethylaminoethyl deriv., P 4301¹.
- C₁₆H₂₈N₂O₃ Glycine, glycyllleucylleucyl-, 5200³.
Glycine, N-[N-(N-leucylglycyl)leucyl]-, 1113⁴, 5200³.
—, leucylleucylglycyl-, 5200³.
Leucine, glycyglycylleucyl-, 5200³.
—, glycyllleucylglycyl-, 5200³.
—, N-[N-(N-leucylglycyl)glycyl]-, 1113⁴, 5200³.
- C₁₆H₂₈O (See also *Muscone*.)
Cyclohexadecanone, 1111³.
C₁₆H₂₈O₂ Cyclohexanecapric acid, P 848⁴.
Cyclopentanebutyric acid, α -heptyl-, P 3543⁴.
Ethanol, 1,1-dicyclohexyl-2-ethoxy-, 113⁴.
Juniperic acid, lactone, 1111³, P 4483³.
Pentadecanoic acid, ξ -hydroxymethyl-, lactone, P 4483³.
Undecylic acid, α -cyclopentyl-, P 3543⁴.
C₁₆H₂₈O₂ Myristic acid, ν -hydroxy-, acetate, 3664³.
C₁₆H₂₈O₃ Galactoside, *l*-menthyl-, 5167⁹.
Glucoside, β -menthyl-, 1881⁴.
C₁₆H₂₈BrO₂ Palmitic acid, α -bromo-, 3664⁴.
C₁₆H₂₈N₂O₂ Butyric acid, β -(N-leucylleucylamino)-, 1389¹.
C₁₆H₂₈ See *Celene*.
C₁₆H₂₈Br₂O₂ 1-Octanesulfonic acid, 3,3'-oxybis(bromo-), salts, 5467⁴.
C₁₆H₂₈ClO₂ 1-Octanesulfonic acid, 3,3'-oxybis(chloro-), salts, 5467⁴.
C₁₆H₂₈N₂ Cyclohexylamine, 4,4'-(1,4-butylene)-bis-, and di-HCl, 2715^{4,7}.
C₁₆H₂₈O Palmitaldehyde, 1902².
C₁₆H₂₈O₂ (See also *Palmitic acid*.)
Butyric acid, dodecyl ester, 4926⁷.
Capric acid, α -hexyl-, 2422¹.
Lauric acid, Bu ester, 4926⁷.
—, α -butyl-, 2422¹.
—, α -*sec*-butyl-, 2422¹.
—, α -isobutyl-, 2422¹.
Myristic acid, α -ethyl-, 2421¹.
Pelargonic acid, heptyl ester, 4926⁷.
—, α -heptyl-, 2422¹.
Pentadecanoic acid, α -methyl-, 2421¹.
n-Tridecoic acid, α -propyl-, 2421¹, 2422¹.
Undecylic acid, α -amyl-, 2422¹.
C₁₆H₂₈O₂ Juniperic acid, 3664⁴.
Pentadecanoic acid, ξ -hydroxy-, Me ester, 3664⁴.
C₁₆H₂₈O₂ Palmitic acid, β , λ -dihydroxy-, 2719⁴.
C₁₆H₂₈BrHg Hexadecane, 1-(bromomercuri)-, 1870⁴.
C₁₆H₂₈ClHg Hexadecane, (1-chloromercuri)-, 1870⁴.
C₁₆H₂₈HgI Hexadecane, 1-(iodomercuri)-, 1870⁴.
C₁₆H₂₈KN₂ Palmitamidine, K salt, 596⁴.
C₁₆H₂₈NO Palmitaldehyde, oxime, 1902².
C₁₆H₂₈N₂O Lauraldehyde, β , γ , ϵ -trimethyl-, semicarbazone, 4926⁷.
C₁₆H₂₈PS₃ Phosphine, triamyl-, CS₂ compd., 4442⁴.
Phosphine, triisomyl-, CS₂ compd., 4442⁴.
C₁₆H₂₈HgO Hexadecane, 1-(hydroxymercuri)-, 1870⁴.
C₁₆H₂₈O (See also *Cetyl alcohol*.)
2-Hexadecanol, 3660⁴.
C₁₆H₂₈O₂S Octyl sulfone, 2419⁴.
C₁₆H₂₈O₂ 1-Octanesulfonic acid, 3,3'-oxybis(salts), 5467⁴.
C₁₆H₂₈N Cetylamine, 4609⁴.
C₁₆H₂₈O₂P Cetyl alcohol, mono-ester with phosphoric acid, and salts, 2417⁴.
C₁₆H₂₈IP Triisomylmethylphosphonium iodide, 4442⁴.
C₁₆H₂₈O₂Si Butyl orthosilicate, 93¹.
C₁₆H₂₈CoO₂P₂S₂ + 8H₂O, 2673⁴.
C₁₆H₂₈MgO₂P₂S₂ + 8H₂O, 2673⁴.
C₁₆H₂₈W₂O₂P₂S₂ + 8H₂O, 2673⁴.
C₁₆H₂₈O₂P₂S₂ + 8H₂O, 2673⁴.
C₁₆H₂₈Cu₂O₂P₂S₂ + 4H₂O, 2673⁴.
C₁₆H₂₈Mg₂O₂P₂S₂ + 2H₂O, 2673⁴.
C₁₆H₂₈Mg₂O₂P₂S₂ + 2H₂O, 2673⁴.

- $C_{17}H_9Cl_2O$ 7-*meso*-Benzanthreneone, 4,9-dichloro-, 4946¹.
- $C_{17}H_{11}N_2O_2S$ Anthraquinone, 2-methyl-1,4-dithiocyano-, 2712¹.
- $C_{17}H_7O_3S$ 5,6,7- γ -Benzothioxanthene-1,2,3-trione, 1901⁸.
- $C_{17}H_9Cl_2O_2$ 5(4)-Isoxazolone, 3-(chlorophenyl)-4-(3-keto-2(3)-indylidene)-, 3219¹.
- $C_{17}H_9ClO$ 7-*meso*-Benzanthreneone, chloro-, P 3477¹, 4945⁹.
- $C_{17}H_9ClO_2S$ Benzo[*g*]thiophanthrene-6,11-dione, 2-chloro-7,10-dihydroxy-4-methyl-, P 5328⁹.
- $C_{17}H_9Cl_2O$ Ketone, *o*(and *p*)-chlorophenyl-5,8-dichloro-1-naphthyl, P 4080¹.
- $C_{17}H_9FO$ 7-*meso*-Benzanthreneone, 3-fluoro-, 4944¹.
- $C_{17}H_9NO$ 7-*meso*-Benzanthreneone, 3-nitro-, 4946¹.
- $C_{17}H_9NO$ Naphth[2,3- η]isoquinoline-5,12-dione, 6,11-dihydroxy-, 3928⁹.
- 6,7- β -Naphthoquinoline-5,12-dione, 6,11-dihydroxy-, 3471⁴, 3929¹.
- $C_{17}H_{11}N_2O_4$ 3-*pers*-Benzophthalazine-3,9(2)-dione, 2-(*p*-nitrophenyl)-, 2435⁸.
- $C_{17}H_{10}Cl_2O$ Ketone, 4,8(and 5,8)-dichloro-1-naphthyl phenyl, P 4080¹.
- $C_{17}H_{10}Cl_2NO$ Anthraquinone, hydroxy(trichloroacetamidomethyl)-, 2173⁸.
- $C_{17}H_{10}O$ 7-*meso*-Benzanthreneone, P 1143¹, 1899¹, P 3477¹, 4472¹, 4945⁹.
- Benzanthrone, P 2579⁹.
- $C_{17}H_{10}O_2$ 7-*meso*-Benzanthreneone, hydroxy-, 8324¹, P 1139¹.
- 11-Chrysofluorenone, 5-hydroxy-, 8324¹.
- $C_{17}H_{10}O_2$ 7-*meso*-Benzanthreneone, dihydroxy-, 2435⁸.
- $C_{17}H_{10}O_2$ 1-Anthraic acid, 9,10-dihydroxy-, γ -lactone, acetate, 3701², 4696².
- $C_{17}H_{10}O_2$ 1-Anthraquinonecarboxylic acid, anhydride with acetic acid, 2711⁸.
- $C_{17}H_{10}O_2S$ Benzoic acid, *o*-(3,4-diketo-1(2)-naphthylsulfanyl)-, 1901⁸.
- $C_{17}H_{10}O_2S$ 2-Anthraquinonecarboxylic acid, 1-(carboxymethylmercapto)-, P 1417⁹, P 1418¹.
- $C_{17}H_{11}NO$ 7-*meso*-Benzanthreneone, 3-amino-, 4946¹.
- $C_{17}H_{11}NO$ Cinnamic acid, β -benzoyl- α -cyano-, 2046¹.
- $C_{17}H_{11}N_2O_2$ 2,1,3-Benzotriazole-2,4'-naphthoic acid, hydroxy-, 836⁹.
- $C_{17}H_{11}BrNO_2$ 2-Naphthanilide, 4-bromo-3-hydroxy-, 1634².
- $C_{17}H_{11}BrO_2$ Furan, 2,5-bis(*p*-bromophenyl)-3-methoxy-, 5471⁷.
- $C_{17}H_{11}Br_2O_2$ Δ^1 -1,4-Butenedione, 1,4-bis(*p*-bromophenyl)-2-methoxy-, 5471⁷.
- $C_{17}H_{11}Br_2NO$ 2(1)-Naphthaleneone, 6-bromo-1(2,4-dibromoanilino)-1-methyl-, 3698⁹.
- 2(1)-Naphthaleneone, 4,6-dibromo-1-bromoanilino-1-methyl-, 3698⁹.
- $C_{17}H_{11}Cl_2NO$ Thyroxine, chloroacetyl-, 1632¹.
- $C_{17}H_{11}Cl_2NO$ Pyrazo[4,5- γ]quinolin-4-ol, 1-(*o*-chlorophenyl)-3-methyl-, 1900⁸.
- $C_{17}H_{11}Cl_2NO_2$ 5-Pyrazolone, 1-(*o*-chlorophenyl)-3-methyl-4-*o*-nitrobenzal-, 2176⁹.
- $C_{17}H_{11}Cl_2O$ 3-Pentadienone, 1-(chlorophenyl)-5-(chlorophenyl)-, 831¹.
- $C_{17}H_{11}Cl_2O_2$ Furan, 2,5-bis(*p*-chlorophenyl)-3-methoxy-, 5471⁷.
- $C_{17}H_{11}Cl_2O_2$ Δ^1 -1,3-Butenedione, 1,4-bis(*p*-chlorophenyl)-2-methoxy-, 5471⁷.
- $C_{17}H_{12}N_2O$ Homoterephthalonitrile, α -anisal-, 2170⁸.
- $C_{17}H_{12}N_2O_3S$ Anhydro- β -naphtholsulfonic-*o*-azobenzyl alcohol, 2163⁹.
- $C_{17}H_{12}N_2O_3$ 3-Pentadienone, 1,5-bis(nitrophenyl)-, 1161².
- $C_{17}H_{12}NO_4$ + H_2O Benzoic acid, *o*-(hydroxydisulfonaphthylazo)-, acid sulfite, *tetra*-*Na* salt, 3462⁹.
- $C_{17}H_{12}NO$ Hydrazomethylene, 1- α -naphthylazo-2-phenyl-1,3-endoxy-, and -*HCl*, 4939⁹.
- Hydrazomethylene, 1-phenylazo-2-naphthyl-1,3-endoxy-, 4939⁹.
- Tetrazole, phenylnaphthyl-3,5-endoxy-, 4939⁹.
- $C_{17}H_{12}NO_2$ Isoquinoline, 1-methyl-6,7-methylenedioxy-, picrate, 2444².
- $C_{17}H_{12}O$ Ketone, naphthyl phenyl, P 715¹, 833⁹.
- $C_{17}H_{12}O_2$ Ketone, 3-hydroxy-2-naphthyl phenyl, P 2157¹.
- 2-Naphthol, benzoate, 1797⁴.
- $C_{17}H_{12}O_2$ Anthraquinone, propionyl-, P 715¹, P 5474¹.
- Ketone, 2,3-dihydroxy-1-naphthyl phenyl, 2135⁹.
- , dihydroxyphenyl 1-naphthyl, 2435⁹.
- Phenanthrenequinone, allylhydroxy-, 1899⁸, 3466¹.
- , (allyloxy)-, 1899⁸, 3466¹.
- 1,2-Phenanthrofurane-10,11-dione, 1,2-dihydro-2-methyl-, 1899⁸.
- $C_{17}H_{12}O_2S$ Benzoic acid, *o*-(2-hydroxy-1-naphthylmercapto)-, 828¹.
- $C_{17}H_{12}O_4$ Anthraquinone, hydroxymethyl-, acetate, 3466⁹, 4696⁹, 4697².
- 1-Anthraquinonecarboxylic acid, 2-methyl-, Me ester, 4696².
- $C_{17}H_{12}O_4$ 1,4-Benzopyran-2-carboxylic acid, 4-keto-7-methoxy-3-phenyl-, 4702⁸.
- $C_{17}H_{12}O_4S$ Thioxanthone, dihydroxy-, diacetate, 3706⁸.
- $C_{17}H_{12}O_4$ Xanthopurpurin, 2-methoxy-, acetate, 4697².
- $C_{17}H_{12}O_4S$ Thioxanthone, 1,4-dihydroxy-, *S*-di-oxide, diacetate, 1901⁸.
- $C_{17}H_{12}S$ *peri*-Naphtho-*m*-dithiin, 2-phenyl-, 135⁸.
- $C_{17}H_{12}Br_2NO$ Aniline, *p*-(4,6-dibromo-1-methyl-2-naphthoxy)-, 3698⁹.
- 2(1)-Naphthaleneone, 1-anilino-4,6-dibromo-1-methyl-, 3698⁹.
- , 6-bromo-1-(*p*-bromoanilino)-1-methyl-, 3698⁹.
- , 1-(2,4-dibromoanilino)-1-methyl-, 3698⁹.
- $C_{17}H_{11}ClNO$ Cinchonamide, *N*-benzyl-2-chloro-, P 1217⁹.
- 5-Pyrazolone, 4-benzal-1-(*o*-chlorophenyl)-3-methyl-, 2176⁹.
- $C_{17}H_{13}ClO$ Cinnamyl chloride, α -styryl-, 2166⁹.
- 3-Pentadienone, 1-(chlorophenyl)-5-phenyl-, 831¹.
- $C_{17}H_{13}ClO_2$ 9-Anthraldehyde, 10-chlorodimethoxy-, P 2447¹, P 3933⁸.
- $C_{17}H_{13}N$ Cinnamonitrile, α -styryl-, 2166⁹.
- $C_{17}H_{13}NOS$ 1-Naphthanilide, 4-hydroxythio-, 3218⁸.
- $C_{17}H_{13}NO_2$ Cinchophen, methyl-, 2215⁷.
- 2-Naphthanilide, 3-hydroxy-, P 612⁹.
- p*-Tolonic acid, α -benzal- α -cyano-, Me ester, 2176⁹.
- $C_{17}H_{13}NO_2S$ β -Resorcylamide, *N*-2-naphthylthio-, 3218⁸.
- $C_{17}H_{13}NO_3$ Benzoic acid, *p*-(4-methyl-2-quinolyl-oxy)-, P 4777⁹.

- Carbostyryl, 3-methoxy-, benzoate, 2443¹.
Cinchophen, 4'-methoxy-, 2215⁷.
Cinnamic acid, α -anisalamino- β -hydroxy-, lactone, 3677⁷, 3914⁴.
Hydrocinnamic acid, β -benzoyl- α -cyano-, 2946¹.
2,3-Pyrroledione, 1-benzoyl-4,5 dihydro-4-phenyl-, 4463⁸.
Salicylic acid, naphthylamino-, P 2044⁸.
C₁₇H₁₁NO₃S Cinchoninic acid, 3-(benzylmercapto)-1,2-dihydro-2-keto-, 2443⁸.
C₁₇H₁₁NO₄ Benzo[γ]naphtho[2,1-*e*]-1,2-pyran-6-one, 7,8,9,10-tetrahydronitro-, 3837⁷.
Oxazole, 5-*p*-aminyl-2-(3,4 methylenedioxyphenyl)-, 2716⁸.
C₁₇H₁₁NO₃S Pyrocatechol, 4-(1-benzothiazolyl)-, diacetate, 5148³.
Resorcinol, 4-(1-benzothiazolyl)-, diacetate, 5184⁴.
C₁₇H₁₁NO₃S Metanilic acid, hydroxynaphthoyl-, P 434⁷.
2-Naphthalenesulfonic acid, 4-(4,3-cresylimino)-1,4-dihydro-1-keto-, 3451¹.
C₁₇H₁₁NO₃ Meconin, 2-(5-methoxy-2-*p*-quinonyl)-3-nitro-, 4682².
C₁₇H₁₁N₃ Anhydro- β -naphthylamine *o*-azobenzyl alcohol, 2163⁹.
C₁₇H₁₁N₃O Pyrazo[4,5- γ]quinolin-4-ol, 3-methyl-1-phenyl-, and -HCl, 1900⁹.
C₁₇H₁₁N₃O₂ 1-Naphthaldehyde, 4-nitrophenylhydrazine, 1377⁷.
Pyrazo[5,4- γ]quinoline-1,4(2,5)-dione, 3-methyl-2-phenyl-, 2443⁸.
C₁₇H₁₁N₃O₂ Tetryl, compd. with naphthalene, 3214³.
C₁₇H₁₁N₃O₂ 2-Naphthylamine, *N*-methyl-6-nitro-, picrate, 4466⁹.
C₁₇H₁₁BrNO 2(1)-Naphthalenone, 1 anilino 6-bromo-1-methyl-, 3698⁸.
2(1)-Naphthalenone, 1-*p*-bromoanilino-1-methyl-, 3698⁸.
C₁₇H₁₁Br₂O 1,4-Butanedione, 1,4 bis *p*-bromophenyl-2-methoxy-, 5471⁷.
C₁₇H₁₁Br₂O Homopterocarpin, dibromo-, 2246⁷.
C₁₇H₁₁Cl₂NO₂ Alaline, β [4-*p*-hydroxyphenoxy]-3,5-diiodophenyl-, chloroacetyl deriv., 1632¹.
C₁₇H₁₁ClN₂O₂ Benzanilide, 2'-chloro-4,4,5-dihydro-5-keto-3-methyl-1-pyrazolyl-, 3906⁸.
C₁₇H₁₁Cl₂O₂ 1,4-Butanedione, 1,4 bis(*p*-chlorophenyl)-2-methoxy-, 5471⁷.
C₁₇H₁₁Cl₂O₂ Acetophenone, *az*-methoxy-*az*, *az'*-oxybis(α -chloro-, P 3931⁷.
C₁₇H₁₁LN₂O₂ Thyroxine, glycol, 1632¹.
C₁₇H₁₁N₂ 1-Naphthaldehyde, phenylhydrazine, 4639⁸.
Quinoxaline, 2-methyl-3-stryl-, 2428⁹.
C₁₇H₁₁N₂O 2-Naphthanilide, 3-amino-, 3909⁸.
C₁₇H₁₁N₂O₂ Benzyl alcohol, *o*-2-hydroxy-1-naphthylazo-, 2163⁹.
1,3,4,6-Oxiazin-5(4)-one, 4-phenyl-2-stryl-, 1905¹.
C₁₇H₁₁N₂O₂S Thiazolidine, 3-benzoyl-2-(benzoylimino)-?, 2177⁸.
 Δ^2 -Thiazoline, 2-dibenzoylamino-, 2177⁸.
C₁₇H₁₁N₂O₂S Benzothiazole, 1-(5-acetamidosalicyl)-, acetate, 5184⁴.
C₁₇H₁₁N₂O₂ Homoveratronic nitrile, α -benzal-2-nitro-, 5186⁹.
C₁₇H₁₁N₂O₂S 1,6-Naphthalenedisulfonic acid, 8-amino-3-*p*-toluino-, sultam, P 609⁴.
C₁₇H₁₁N₂O₂ Dianhydride of acid from Hansen's acid, 4707⁴.
C₁₇H₁₁N₂O₂S₂ 1,6-Naphthalenedisulfonic acid, 8-amino-3-*p*-methoxyanilino-, sultam, P 609⁴.
C₁₇H₁₁N₂O₂ 5-*m* Dioxanol, 2-(*p*-nitrophenyl)-, *p*-nitrobenzoate, 597¹.
1,3 Dioxolane-4-carbinol, 2-(*p*-nitrophenyl)-, *p*-nitrobenzoate, 597¹.
Homopterocarpin, dinitro-, 2246⁸.
C₁₇H₁₁N₂S 1-Naphthoic acid, thiono-, β -phenylhydrazide, 4939⁹.
C₁₇H₁₁N₂O₂ Isoquinoline, 3,4-dihydro-1 methyl-6,7-methylenedioxy-, picrate, 2444².
C₁₇H₁₁N₂O₂S Thiazole, 2-amino-5-(4-amino-methyl)-4-methyl-, picryl deriv., 1410⁴.
C₁₇H₁₁N₂O₂S Acetic acid, bis[4,5-dihydro-4-phenyl-5-thio keto-1-(1,2,3,4-tetrahy)]-, Me ester, 4471¹.
C₁₇H₁₁O 1-Indanone, 2-benzal-6-methyl-, 2706⁹.
1-Indanone, 2-*p* methylbenzal-, 2706⁹.
Ketone, anthryl ethyl, P 715⁷.
3-Pentadienone, 1,5-diphenyl-, 2171⁸.
C₁₇H₁₁O Anthrol, methyl-, acetate, 5183⁴.
Benzo[γ]naphtho[2,1-*e*]-1,2-pyran-6-one, 7,8,9,10 tetrahydro-, 3837⁷.
Flavone, 5,7-dimethyl-, 1122².
Furan, 3-methoxy-2,5-diphenyl-, 5471⁸.
1,2- α -Naphthopyrone, 3-allyl-4-methyl-, 2959⁷.
Pentene acid, δ -hydroxy- β , δ -diphenyl-, lactone, 3210⁸.
C₁₇H₁₁O Δ^2 Fluoreneacetic acid, α -methoxy-, Me ester, 842⁷.
Glutaric anhydride, α , β diphenyl-, 4930⁷.
3-Pentadienone, 1,5 bis *p* hydroxyphenyl-, 3686⁸.
C₁₇H₁₁O Anthraquinone, 1,5-dimethoxy-2-methyl-, 2174⁹.
C₁₇H₁₁O Anthraquinone, 1,2,7 trimethoxy-4214¹.
Anthrone, 1,2 dihydroxy-, 2 ethylcarbonate, 4697⁹.
C₁₇H₁₁O Chrysin, 2',4'-dimethoxy-, 2181⁷.
Coumarin, 3-(3,4 dimethoxyphenyl)-5,7 dihydroxy-, 4681⁸.
C₁₇H₁₁O Chalcone, 2',4,4',6' tetrahydroxy-, 4 Me carbonate, 2162².
Desmethyl-des-*N*-trilobinoldicarboxylic acid, 3933⁹.
Des-*N*-trilobinoldicarboxylic acid, desmethyl-, 3933⁹.
Meconin, 2-(5-methoxy-2-*p*-quinonyl)-, 4682².
Naringenin, Me carbonate, 2162².
C₁₇H₁₁O Syringetin, 2181⁷.
C₁₇H₁₁O₂S Benzoic acid, *o*-2,5 dihydroxyphenylsulfonyl-, diacetate, 1901⁸.
C₁₇H₁₁O Hemipic acid, 6-carboxyphenyl-, 4222⁸.
C₁₇H₁₁BrO₂ Chalcone, α -bromo β -ethoxy-, 4911¹.
C₁₇H₁₁BrO₂ 5-*m*-Dioxanol, 2 phenyl-, *p* bromobenzoate, 2939⁷.
1,3- Dioxolane-4-carbinol, 2-phenyl-, *p*-bromobenzoate, 2939⁷.
C₁₇H₁₁Br₂NO₂ Morphine, tetrabromo-, -H₂O, 5187².
C₁₇H₁₁ClN₂O₂S Oxazolidine, 2-(benzoylimino)-(chloromethyl)-3-(phenylsulfonyl)-, 2177⁸.
C₁₇H₁₁ClO₂ β -Butenic acid, α -(α -chlorobenzyl)phenyl-, 1394⁸.
 Δ^1 -3-Pentenone, δ -(chlorophenyl)-5-hydroxy-1-phenyl-, 831¹.
C₁₇H₁₁ClO₂ 1,2-Propanediol, 3-chloro-, disulfoxide, 4683⁸.
C₁₇H₁₁ClO Anthocyanidin chloride, 2462¹

- Delphinidin chloride, (5-Me ether, 2462*.
C₁₇H₁₇N Aniline, *N*-(ϵ -phenyl- $\Delta^{2,3}$ pentadienylidene)-, 3687*.
 Pyrrole, 1-methyl 2,5-diphenyl-, 1108*.
 Quinoline, 4-ethyl 2 phenyl-, 2443*.
C₁₇H₁₇NO Cinnamamide, α -styril-, 2166*.
 Cresol, naphthylamino-, P 2041*.
 2(1)-Naphthalenone, 1- amino- 1 methyl-, 3698*.
 2-Naphthol, (α aminobenzyl)-, and -HCl, 2172*4.
 2-Naphthylamine, 6-benzyloxy-, P 2188*.
 Quinolinol, 4-ethyl-2-phenyl-, 2443*.
C₁₇H₁₇NO₂ Glutarimide, α , β -diphenyl-, 4930*.
 Oxazole, *p*-anisyl-*p*-tolyl-, and -HCl, 2746*4.
C₁₇H₁₇NO₂ Benzil, *m*-methyl-, oxime, acetab-, 2709*.
 Benzoic acid, *p* (*p* methoxy)cinnamalamino-, 3011*.
 Phthalimide, *N*-(2-methyl *p* phenetyl)-, 1888*.
 Quinaldic acid, 1-benzoyl-1,2,5,4 tetrahydro-, 1411*.
C₁₇H₁₇NO₄ Glyoxylic acid, (α benzamidophenyl)-, Et ester, 4469*.
C₁₇H₁₇NO₄ 5-*m*-Dioxanol, 2-*p* nitrophenyl-, benzoate, 596*9.
 5-*m*-Dioxanol, 2 phenyl-, *p* nitrobenzoate, 2939*.
 1,3 Dioxolane 4 carbanol, 2-*p* nitrophenyl-, benzoate, 596, 597*.
 2 phenyl-, *p* nitrobenzoate, 2939*.
C₁₇H₁₇N₂O Phenylhydrazine, *m* 1656, of compd m. 100-1*, 4218*.
p-Tolunitile, α , α' -methyliminobis-, and -HCl, 4456*.
C₁₇H₁₇N₂O Benzyl alcohol, ϵ 2-amino 1 naphthylazo-, 2163*.
 1,5-Fluoranthene, 6,6a dihydro-, sem carbazone, 2713*.
 Ketone, 2-hydroxy-3-quinolyl methyl phenylhydrazine, 1900*.
 2 Naphthamide, 3 hydrazino-, -HCl, 2909*.
C₁₇H₁₇N₂O₃ 3,5,1 Pyrazololcarboxy *p* toluol-, 5 keto 3 phenylthio-, 388*.
C₁₇H₁₇N₂O₃ Benzamide, 4,5 dihydro 5 keto 1 methyl 1 pyrazolyl-, 3909*.
 2 Naphthamide, hydrazino-, -HCl, 3909*.
 1,3,4 Triazole 1 α benzoic acid, 2 methyl 5 phenyl-, Me ester, 836*.
C₁₇H₁₇N₂O₃ Benzenesulfonamide, *p* formyl-, 1 naphthylhydrazine, 4680*.
 Benzenesulfonazole, 1,2 dihydro 2- β 1 naphthylhydrazino-, 4680*.
C₁₇H₁₇F₃O₃ Phthalazine-4 acetic acid, 1 hydroxy-1,3' nitrophenyl 1,3 dihydro-, Me ester, 146*.
C₁₇H₁₇N₂O₄ Propiophenone, β ethoxy m di nitro β (*m* nitrophenyl)-, 116*.
C₁₇H₁₇N₂S Thiazole, 4-*p*-tolyl-2- α -tolylazo-1119*.
C₁₇H₁₇N₂O₄ Ketone, aminomethyl 2-methyl 3 indyl-, picrate, 3929*.
C₁₇H₁₇Br₂O₄ Homopterscarpin, dibromodihydro-2246*.
C₁₇H₁₇ClN₂ Ketone, chloromethyl 2 methyl 3 indyl-, phenylhydrazine, 4215*.
C₁₇H₁₇ClN₂O₄ Ketone, 3,4 dihydro-2,4 dihydroxy-3-quinolyl methyl-, α chlorophenylhydrazine, 1900*.
C₁₇H₁₇N₂O₄ Alanine, β -[4 (*p* hydroxyphenoxy) 3,5 diiodophenyl]-, glycol deriv., 1832*.
C₁₇H₁₇N₂ Pyrazole, 4-ethyl 3,5-diphenyl-, 4701*.
C₁₇H₁₇N₂O $\Delta^{2,3}$ -2-Pentadienol, δ -anilino-1 phenylimino-, -HCl, 2439*.
C₁₇H₁₇N₂O 1,3,4,6-Oxadiazin 5(4) one, 2 phenethyl-1-phenyl-, 1904*.
C₁₇H₁₇NO Acridine, 5-acetamido-2,8-dimethoxy-, 1901*.
C₁₇H₁₇NO Benzene acid, 2 (*p* dimethylamino-styryl) 5 nitro-, 2166*.
 8 digamm, 5 phenylazo-, diacetate, 121*.
C₁₇H₁₇NO Isoquinoline, 3,4 dihydro 6,7 dimethoxy-, picrate, 2448*.
C₁₇H₁₇NO 1,2,4 Triazole, 3,5-dimethyl-1-tolyl-, picrate, 3226*7.
C₁₇H₁₇N₂S 1,2,3,4 Tetrazole, 5,5' methylene-dithio-bis[1- α and β tolyl], 4470*.
 1,2,3,4 Tetrazol 5(4) one, 1,1' methylene-bis[5 thio 1 α and β tolyl], 4470*.
C₁₇H₁₇O 1 Indanone, 2 benzylmethyl-, 2706*9.
 Indanone, 2 *p* methylbenzyl-, 2706*.
 1,2-Naphthalenone, 3,4 dihydro-1-*p* tolyl-, 2706*.
C₁₇H₁₇O Acrylic acid, α , β diphenyl-, Et ester, 2709*.
 β -Butene acid, α methyl- γ , γ diphenyl-, 5181*.
 Chalcone, β ethoxy-, 3683*.
 2 Naphthoic acid, 1,2,3,4 tetrahydro-1-phenyl-, 1355*.
 β Pentenic acid, α , α diphenyl-, 5181*.
 Valeric acid, δ hydroxy β , δ diphenyl-, lactone, 3211*.
C₁₇H₁₇O Acetophenone, 4 hydroxy 2-methoxy- α phenyl-, acetate, 2180*.
 1,3 Butanedione, 1 *p* anisyl 4 phenyl-, 1256*.
 1,4 Butanedione, 2-methoxy-1,1-diphenyl-, 7471*.
 Cinnamic acid, α benzyl-*p* methoxy-, 2959*.
 α , α' -dimethoxybenzyl-, 2959*.
 Cyclopropanecarboxylic acid, 2-(α -hydroxybenzyl 3 phenyl-, 1391*.
 Glycolic acid, β , β -diphenyl-, Et ester, 4212*.
C₁₇H₁₇O See also *Homopterscarpin*.
 Gouty acid, α , β diphenyl-, 4930*.
 Phthalic acid, benzyl-ethyl ester, P 1417*.
 1,3 Propanedione, 1,3 di *p* anisyl-, 1256*.
 α Toluic acid, α phenoxy- γ -tolyl-, Me ester, 4181*.
C₁₇H₁₇O Flavonone, 5 hydroxy-4',7 dimethoxy-, 2161*.
 1-phenylbodanin, mono Me ether, 2714*.
 Malonic acid, naphthyl(methyl)-, di Me ester, 3793*.
C₁₇H₁₇O₂ 2 Naphthol, 3,6 dimereapto-, Et carbonate, diacetate, 1129*.
C₁₇H₁₇O₂ Coumarin, 3 allyldihydroxy-4-methyl-, diacetate, 2959*.
 Flavonone, 5,7 dihydroxy-3',4'-dimethoxy-4210*.
C₁₇H₁₇O₂ Meconin, 2-(2,5 dihydroxy-*p* anisyl)-, 4682*.
C₁₇H₁₇ClO Butyryl chloride, γ phenyl- γ -*p*-tolyl-2706*.
C₁₇H₁₇Cl₂N₂Et 4217*.
C₁₇H₁₇N Butyrolimide, γ phenyl- γ -*p*-tolyl-2706*.
C₁₇H₁₇NO 1-Indanone, 2 benzylmethyl-, oxime, 2706*9.
 1 Indanone, 2 *p* methylbenzyl-, oxime, 2706*9.
p Toluidine, *N* *p*-methoxycinnamal-, 3911*.
C₁₇H₁₇NO₂ (See also *Apomacaine*).
 Acridine, diethoxy-, P 3543*.
p-Anisidine, *N* *p* methoxycinnamal-, 3911*.
 Chalcone, 4-ethoxy-, oxime, 4701*.
p Cinnamotolide, *p*-methoxy-, 1396*.
 2 Indolol, 1 benzyl 1,3,3-dimethyl-, 3927*

- C₁₇H₁₇NO₃ Acetylbenzalphenylammonium acetate, 2951¹.
p-Cinnamanilide, *p*-methoxy-, 1396².
 Hydrocinnamic acid, 2-benzamido-5-methyl-, 126¹.
 C₁₇H₁₇NO₃ Acridine, bis(hydroxyethoxy)-, P 3543⁴.
 Coniferyl alcohol, carbanilate, 2983⁹.
 Hydrocinnamic acid, 2-benzamido-5-methoxy-, 126¹.
 Isobutyric acid, β -amino- β -(3,4-methylene-dioxypheyl)- β' -phenyl-, -HCl, 1893¹.
 1-Propanol, 1-phenyl-2-(piperonylideneoximino)-, 4205⁷.
 C₁₇H₁₇NO₃ Flavanone, 5,7-dihydroxy-3',4'-dimethoxy-, oxime, 4210⁸.
 C₁₇H₁₇N₃O 1-Indanone, 3-tolyl-, semicarbazone, 2706^{5,7}.
 1(2)-Naphthalenone, 3,4-dihydro-3-phenyl-, semicarbazone, 2710¹.
 C₁₇H₁₇N₃O₂ Benzamide, 2-(*p*-dimethylamino-styryl)-5-nitro-, 2166⁴.
 4-Chromanone, 2,2-dimethyl-, *p*-nitrophenylhydrazine, 1901³.
 C₁₇H₁₇N₃O₂S *p*-Toluenesulfonanilide, 3'-(4,5-dihydro-5-keto-3-methyl-1-pyrazolyl)-, 3909³.
 C₁₇H₁₇N₃O₂ Pyruvic acid, (*o*-nitrophenyl)-, 2,5-xylylhydrazine, 4699⁹.
 C₁₇H₁₇N₃S Thiazole, 2-amino-5-(aminotolyl)-4-tolyl-, and salts, 1410^{3,4}.
 Thiazole, 4-*p*-tolyl-2-(β -tolylhydrazino), 1410^{3,4}.
 Δ^4 -Thiazoline, 2-imino-3-*p*-toluino-4-*p*-tolyl-, 1410³.
 C₁₇H₁₇N₃O₂ Diethylbenzimidazolium picrate, 1638³.
 C₁₇H₁₇ 1-Butene, 3-methyl-1,1-diphenyl-, 3908².
 C₁₇H₁₇BrNO₂ Morphine, bromo-, -HBr, 5187².
 C₁₇H₁₇Br₂N₂O₂ 4-Isopyrrolepropionic acid, 5-bromo-2-[5-bromo-4-(β -carboxyethyl)-3-methyl-2-pyrryl]methylene]-3-methyl-, -HBr, 1433².
 C₁₇H₁₇IN 1,3,3-Trimethyl-2-phenylpseudon-
 -sodium iodide, 3927².
 C₁₇H₁₇N₂O Indoline, 2-amino-1-benzoyl-3,3-di-
 methyl-, 3927².
 Valeranilide, γ -phenylimino-, 4193⁴.
 C₁₇H₁₇N₂O₂ Δ^2 -4-Isoxazolinol, 5-aniligo-3,4-di-
 methyl-5-phenyl-, 2974⁴.
 C₁₇H₁₇N₂O₂ Barbituric acid, 5 β -diallyl-1-benzyl-,
 821².
 C₁₇H₁₇N₂O₂ Benzamide, *N*-(β -hydroxy- α -methyl-
 phenethyl)-*N*-methyl-*p*-nitro-, 3689^{3,4}.
p-Phosetidine, *N*-(5-ethoxy-2-nitrobenzal)-,
 3929².
 C₁₇H₁₇N₂O₂ Glutaconic acid, β -benzyl- α -car-
 bamyl- γ -cyano-, Et Me ester, 4685⁹.
 C₁₇H₁₇N₂O₂ Acid from Hanassen's acid, and
 -HCl, 4707^{2,3}.
 C₁₇H₁₇N₂S Carbanilide, *p* isobutenylthio-, 4685⁹.
 C₁₇H₁₇N₂O₂S Carbanilide, *p*, *p'*-diacetamidothio-,
 2158¹.
 Pseudourea, γ -ethyl- α , β -bis(phenylcarbamyl)-
 thio-, 3902².
 C₁₇H₁₇N₂O₂ Glycine, *N*-[*N*-(1-naphthylcarb-
 amyl)glycyl]glycyl-, 1389⁹.
 C₁₇H₁₇N₂O₂ Acetanilide, α -(alanilamino)-, pic-
 rate, 1113¹.
 Propionanilide, α -glycylamino-, picrate,
 1112².
 C₁₇H₁₇N₂O₂S Methionanilide, *N*, *N'*-diethyl-
 2,4,2',4'-tetranol-, 99².
 C₁₇H₁₇N₂O₂ 2(1)-s-Triazone, 4-(β -dimethyl-
 aminophenyl)tetrahydro-6- β -imino-,
 picrate, and its hydrochlorides, 4221^{3,4,5}.
 C₁₇H₁₇O 2-Butanone, 3-benzyl-4-phenyl-, 3927².
 Ethylene oxide, α -benzyl- α -ethyl- β -phenyl-,
 2958².
 C₁₇H₁₇O₂ Butyric acid, γ -phenyl- γ -*p*-tolyl-,
 2706⁵.
 Isobutyric acid, β -phenyl- β' -tolyl-, 2706^{5,6}.
 Isovaleric acid, α , α -diphenyl-, 5181⁴.
 Phenol, cyclopentylidenebis-, 4689².
 Valeric acid, β , δ -diphenyl-, 3211¹.
 C₁₇H₁₇O₂ Carbonic acid, diphenethyl ester, 1247².
 Ethanol, 1-*p*-anisyl-2-phenyl-, acetate, 2179².
 Hydroacrylic acid, α -phenethyl- β -phenyl-,
 1395¹.
 C₁₇H₁₇O₂ Homopterocarbin, dihydro-, 2246⁵.
 C₁₇H₁₇O₂ Mandelic acid, α -[(*m*-anisyl-
 methyl)-, *Me* ester, 4702³.
 C₁₇H₁₇O₂ γ -Pentenic acid, α -acetyl- δ -(*m*-
 dioxypheyl)- β -keto-, Et ester, methyl
 carbonate, 4211¹.
 C₁₇H₁₇Br₂NO₂S 1-Phenol-4-sulfonic acid, 2,6-di-
 bromo-, Bu *p*-aminobenzoate compd.,
 P 2535¹.
 C₁₇H₁₇HgNO₂ Benzylamine, *N*-[*p*-(acetoxymer-
 curi)phenyl]-*N*-ethyl-, 1890¹.
 C₁₇H₁₇INO₂S 1-Phenol-4-sulfonic acid, 2,6-di-
 iodo-, Bu *p*-aminobenzoate compd.,
 P 2535¹.
 C₁₇H₁₇N Diphenylamine, *N*- α -methyl-
 butenyl-, P 3052².
 Indoline, 1,3,3-trimethyl-2-phenyl-, 3927².
 Quinoline, 1,2,3,4-tetrahydro-6,8-dimethyl-
 2-phenyl-, and salts, 392².
 C₁₇H₁₇NO 2-Butanone, 3-benzyl-4-phenyl-,
 oxime, 3927².
 Isobutyramide, β -*p*-methylbenzyl- β' -phenyl-,
 2706⁵.
 Propiophenone, α -dimethylamino- β -phenyl-,
 2117⁴.
 Quinoline, 2-*p*-anisyl-1,2,3,4-tetrahydro-
 methyl-, and salts, 3927².
 α -Toluanilide, α -isopropyl-, 4461².
 C₁₇H₁₇NO₂ Benzyl alcohol, α -(dimethylamino-
 methyl)-, benzoate, 4269².
 Hydrocinnamic acid, *o*-(*N*-methylamino)-,
 Me ester, 126¹.
 C₁₇H₁₇NO₂S 1-Butanol, 4-phenylmercapto-, carb-
 anilate, 2423¹.
 C₁₇H₁₇NO₂ (See also *Dilaudid*; *Moraine*;
Piperine.)
 Benzyl, methyl-, oxime, dimethyl acetid,
 2708⁵, 2709^{3,4,5,6}.
 Benzyl alcohol, α -(*p*-piperonylaminoethyl)-,
 4205⁷.
 Coclaurine, 2979², 5272⁹.
 1-Propanol, 3-anisyl-, carbanilate, 1977².
 C₁₇H₁₇NO₂S 2-Butanone, 4-phenyl-, oxime, *p*-
 toluenesulfonate, 1895².
 C₁₇H₁₇NO₂ Hydrochloride of compd., m. 238-
 40°, from methylpapaverine, 4220².
 1-Propanol, 1-phenyl-2-(vanillideneoximino)-,
 4205⁷.
 C₁₇H₁₇NO₂ Valeric acid, α -acetyl- δ -phthalimido-,
 Et ester, 834².
 C₁₇H₁₇N₂ Clannamaldehyde, β -dimethylamino-
 phenylhydrazine, 381¹.
 C₁₇H₁₇N₂O Butyrophenone, γ -phenyl-, sen-
 carbazone, 1396².
 4(5)-Indolone, 6,7-dihydro-3,6,6-di-
 methyl-2-phenylazo-, 2716².
 2-Pyrrolidone, 5-hydroxy-1-methyl-5-
 phenyl-, phenylhydrazine, 1405².

- $C_{17}H_{19}N_3O_2$ Camphanthoquinolnecarboxylic acid, amino-, 2169².
p-Phenylenediamine, *N,N'*-diethyl-*N'*-*p*-nitrobenzal-, 3919².
 $C_{17}H_{19}N_3O_8$ Benzoic acid, *p*-nitro-, *β* carvacryl hydrazide, 5470⁴.
 $C_{17}H_{19}N_3O_8$ Glycine, *N*-[*N*-(2-naphthylsulfonyl)alanyl]glycyl-, 4102².
 $C_{17}H_{19}N_3O_8$ Oxime of acid from Hansen's acid, 4707².
 $C_{17}H_{19}N_3O_8$ 2-Furanpropylamine, picrolonate, 3877.
 $C_{17}H_{20}$ Hydrocarbon from agathidic acid, 3712¹.
 $C_{17}H_{20}BrNO$ Benzyl dimethylphenacylammonium bromide, 2117².
 $C_{17}H_{20}BrN$ Aniline, 4,4'-methylenebis[3-bromo-*N,N*-dimethyl-, P 606².
 $C_{17}H_{20}Cl_2N$ Aniline, 4,4'-methylenebis[3-chloro-*N,N*-dimethyl-, P 606².
 $C_{17}H_{20}IN$ Trimethyl(α-methylenebenzyl)ammonium iodide, 4689².
 $C_{17}H_{20}N_2$ Camphanthoquinoline, 7 (or 8)-methyl-, 2168².
 $C_{17}H_{20}N_2O$ Salicylaldehyde, carvacrylhydrazone, 5470⁴.
 $C_{17}H_{20}N_2O_2$ 2-Camphidone, 4 imino-, benzoyl deriv., 2960².
Cinchoninamide, 2 allyloxy-*N,N*-diethyl-, P 1217².
Cinchoninic acid, 2-ethoxy-, piperidide, P 1217².
3-Indazolecarboxylic acid, 2 benzyl 1,5,6,7-tetrahydro-4,6-dimethyl-, 2972².
3-Isindazolecarboxylic acid, 1-benzyl-4,5,6,7-tetrahydro-4,6-dimethyl-, 2972².
1-benzyl-4,5,6,7-tetrahydromethyl-, Me ester, 2972².
4,5,6,7-tetrahydro-4,6-dimethyl-1-phenyl-, Me ester, 2972².
4,5,6,7-tetrahydro-5-methyl-1-phenyl-, Et ester, 2972².
p-Phenetidine, 2-(*p*-phenetyliminomethyl)-, 3929².
 $C_{17}H_{20}O_4$ 4-Isopropylpropionic acid, 2-[(1-(*p*-carboxyethyl)-3-methyl-2-pyrryl)methylene]-3-methyl-, -HBr, 1133².
 $C_{17}H_{20}O_8$ Glycine, *N*-(*N*-2-naphthylsulfonylvalyl)-, 1618².
 $C_{17}H_{20}NO$ Indole, 4,5,6,7-tetrahydro 3,6,6-trimethyl-, picrate, 2718².
 $C_{17}H_{20}NO_2$ 1-Butanol, 3-methylamino 3 phenyl-, picrate, 4462².
Ephedrine, *N*-methyl-, picrate, 1472².
 $C_{17}H_{20}O$ 2-Butanol, 2-methyl-4,4-diphenyl-, 3908¹.
Ether, α-2-isopropylbenzohydril methyl-, 5181².
3-Pentanol, 1,5-diphenyl-, 2171².
 $C_{17}H_{20}O_2$ *m*-Cresol, isopropylidenebis-, P 1011², 4689².
Methane, phenethyloxy-3,4-xylyloxy-, 1871².
3,4-Phenanthrofurane, 1,2,3a,4,5,5a,11b,11c-octahydro-10-methoxy-, 3710¹.
 $C_{17}H_{20}O$ Camphor, hydroxy-, benzoate, 3693².
Hydrobenzoic acid, α-ethyl-*p*-methoxy-, 4687².
 $C_{17}H_{20}O_8$ 1,3-Propanediol, di-*p*-toluenesulfonate, 931.
 $C_{17}H_{20}BrCl_2NO_2$ Tyrosine, *N*-[*N*-(α-bromoisocaproyl)glycyl]-3,5-dichloro-, 2993².
 $C_{17}H_{20}Br_2N_2O_4$ Tyrosine, *N*-[*N*-(α-bromoisocaproyl)glycyl]-3,5-diiodo-, 2993².
 $C_{17}H_{20}Br_2NO_2$ 4-Isopropylpropionic acid, 5-bromo-2-[(ethyldimethyl-2-pyrryl)methylene]-3-methyl-, -HBr, 1134².
 $C_{17}H_{20}BrNO$ Cocaine, dibromo-, -HBr, 5187².
 $C_{17}H_{20}Br_2NO$ Tyrosine, 3,5-dibromo-*N*-(α-bromoisocaproylglycyl)-, 2993².
 $C_{17}H_{20}ClO_6$ Malonic acid, (*p*-carboxybenzyl)-chloro-, tri Et ester, 1381.
 $C_{17}H_{20}F_8Sn$ Stannane, benzylbutylfluorophenyl-, 1158.
 $C_{17}H_{20}N$ Dibenzylamine, *N,p,p'*-trimethyl-, 4450².
 $C_{17}H_{20}NO$ Benzyl alcohol, α-α-phenethylaminoethyl-, and -HCl, 3154².
 $C_{17}H_{20}NO$ Belladonna, *alt.*, 2183².
2-Hexanol, 1-naphthalenecarbamate, 100.
α-γ-Pentadienic acid, 3-*p*-anisyl-, piperidide, 3912².
1-Triethyl[2,2,1,0⁴]heptanecarbinol, 7,7-dimethyl-, carbamate, 1686².
 $C_{17}H_{20}NO$ Benzyl alcohol, α-1α-2 dihydro 3-methoxybenzylammonioethyl-, 4205².
Benzyl alcohol, α-α-vinylaminoethyl-, 1205².
Ethanol, 2-methylamino-1,2-diphenyl-, acetate, 1462².
 $C_{17}H_{20}NO_2$ (See also Cocaine, Hyoscin, Scopolamine).
Cinnamic acid, 3,4-methylenedioxy-, β-1-piperidylethyl ester, -HCl, 2499².
 $C_{17}H_{20}NO_8$ 2-Butanone, 3-amino-1-phenyl-, *p*-toluenesulfonate, 1895².
 $C_{17}H_{20}NO$ Camphoramide acid, 2'-carboxy-, 1291.
 $C_{17}H_{20}NO_8$ 2-Camphidone, 4 imino-, phenylthiocarbamyl deriv., 2960².
 $C_{17}H_{20}NO_8$ Benzenesulfonic acid, (*p*-β-diethylaminoethylazo)-, Me ester, 4201².
 $C_{17}H_{20}NO_8$ Barbituric acid, 1,5,5-triethyl-3-*p*-nitrobenzyl-, 821².
 $C_{17}H_{20}Br_2N$ Isopropole, 5-bromo-2-[(5-bromo-3,4-diethyl-2-pyrryl)methylene]-3,4-diethyl-, -HBr, 2184².
 $C_{17}H_{20}ClNO_2$ Glycine, *N*-[*N*-(*p*-chlorophenyldeacyl)glycyl]-, 4192².
 $C_{17}H_{20}N_2$ Arginine, *p,p'*-isopropylidenebis[*N*-methyl-, and -HCl, 4688².
 $C_{17}H_{20}N_2O$ Benzohydrol, *p,p'*-bis(dimethylamino)-, 3841.
Isopropole, 4-acetyl-2-(1-ethyl-3,5-dimethyl-2-pyrryl)methylene-3,5-dimethyl-, *deriv.*, 5191².
 $C_{17}H_{20}N_2O_2$ Cinchoninamide, *N,N'*-methyl-2-isopropoxy-, P 1217².
Cinchoninamide, *N,N'*-diethyl-2-propoxy-, P 1217².
4-Isopropylpropionic acid, 2-[(ethyldimethyl-2-pyrryl)methylene]-3-methyl-, -HBr, 1134².
p-Phenetidine, 2-(*p*-ethoxyanilinomethyl)-, 3929².
3-Pyrrolopropionic acid, 5-[(3-ethyl-4,5-dimethyl-2-isopropylidene)methyl]-2-methyl-, -HBr, 1134².
 $C_{17}H_{20}N_2O$ Barbituric acid, 5-ethyl-5-isomethyl-phenyl-, 3021².
Cinchoninic acid, 1,2-dihydro-2-keto-1-methyl-1-diethylaminoethyl ester, P 1945².
—, 2-methoxy-1-diethylaminoethyl ester, P 1905².
 $C_{17}H_{20}N_2O_8$ Acetaminide, *N*-phenethyl-, *p*-toluenesulfonate, 1895².

- C₁₇H₂₂N₂O₄S₂ Methionanilide, *N*, *N'*-diethyl-, 987.
- C₁₇H₂₂N₂O₄ Acid, m. 312-4° (decompn.) from oxidation of vomicine, 3475¹.
- C₁₇H₂₂N₂O₄ Acid, does not m. 345°, from oxidation of brucine, *and salts*, 3474^{1,4}.
- C₁₇H₂₂N₂O₇ Acid, m. 262° (decompn.), from oxidation of vomicine, 3475¹.
- C₁₇H₂₂N₂O Guanidine, (*p*-dimethylaminophenyl)-*p*-phenyl-, P 5475⁴.
- C₁₇H₂₂N₂O₇ Glycine *N*-[*N*-[*N*-(*p*-nitrobenzoyl)-leucyl]glycyl]-, 4192³.
- C₁₇H₂₂N₂S Carbanilide, *p*, *p'*-bis(dimethylamino)-thio-, P 3233².
- C₁₇H₂₂N₂O₇ Glycine *N*-[*N*-[*N*-(*N*-phenylcarbamylglycyl)glycyl]glycyl]-, 1388².
- C₁₇H₂₂O Ketone, 2-camphanyl phenyl, 2433².
- C₁₇H₂₂OS₂ Stannane, benzylbutylhydroxyphenyl-, 118².
- C₁₇H₂₂O₂ Camphor, phenylhydroxy-, Me ether, 1405².
- C₁₇H₂₂O₄ Malonic acid, (*p*-carboxybenzyl)-, tri-Et ester, 1384¹.
- C₁₇H₂₂BrN₂O₄ Leucine, *N*-[*N*-(α -bromohydrocinnamyl)glycyl]-, 2992⁴.
- C₁₇H₂₂BrN₂O₄ Tyrosine, 3,5 dibromo-*N*-(*N*-leucylglycyl)-, 2993².
- C₁₇H₂₂Cl₂N₂O₄ Tyrosine, 3,5-dichloro-*N*-(*N*-leucylglycyl)-, 2993².
- C₁₇H₂₂I₂N₂ Benzylethyl-4,5,6,7-tetrahydro-5-methylindazolium iodide, 2972².
- Benzyl - 4,5,6,7 - tetrahydrotrimethylindazolium iodide, 2972².
- C₁₇H₂₂I₂N₂O₄ Tyrosine, 3,5-diiodo-*N*-(*N*-leucylglycyl)-, 2993².
- C₁₇H₂₂N₂O₄ (See also *Atropine*; *Hyoscyamine*) Camphoranilic acid, 2'-methyl-, 129¹.
- 3-Pyrrolecarboxylic acid, 1-(3-camphoryl)-2,5-dimethyl-, 2961¹.
- C₁₇H₂₂NO₃ 3-Camphorsulfonotoluide, 1887¹.
- C₁₇H₂₂NO₄ Camphoranilic acid, 2'-methoxy-, 129¹.
- Cinnamic acid, 3,4-methylenedioxy-, γ -diethylaminopropyl ester, -HCl, 2499².
- C₁₇H₂₂NO₄ Malonic acid, (α -aminopiperonyl)ethyl-, di-Et ester, -HCl, 1892².
- C₁₇H₂₂NO₆ Rhamnohexononitriles pentaacetyl-, 2942¹.
- C₁₇H₂₂N₂O Camphor, 4-phenylsemicarbazone, 600².
- C₁₇H₂₂N₂O₄ Piperidine, 4-(4-cyclohexyl-2,5-dimetrophenyl)-, 2947².
- C₁₇H₂₂N₂O₄ Glycine, *N*-[*N*-(*N*-benzoylleucyl)glycyl]-, 2992².
- C₁₇H₂₂N₂O₄ Glycine, *N*-[*N*-[*N*-(β -phenylcarbamido)butryl]glycyl]glycyl]-, 2993².
- 2-Furanpropylamine, tetrahydro-, picrolone, 387².
- C₁₇H₂₂AsNO₄ Benzoic acid, 4-dihydroxyarsyl-3-nitro-, menthyl ester, 2959².
- C₁₇H₂₂AsNO₇ Benzoic acid, 4-arsono-3-nitro-, menthyl ester, *and di-Na salt*, 2959².
- C₁₇H₂₂Cl₂NO₄ Trigeminal, 141¹.
- C₁₇H₂₂N₂OS Benzothiazole, 1-heptylamino-3-methyl-, acetyl deriv., 835².
- C₁₇H₂₂N₂O₄ Butyric acid, β -[(*N*-benzoylleucyl)amino]-, 1389¹.
- Glycine, *N*-(*N*-benzoylleucyl)-, Et ester, 603².
- Nipicotic acid, hydroxypropyl-, aminobenzoate, methyl ester, -HCl, P 4777⁴.
- 2-Piperidineethanol, 1-propyl-, *p*-nitrobenzoate, -HCl, 1902².
- 4-Piperidinol, 1-isoamyl-, *p*-nitrobenzoate, -HCl, 1902².
- C₁₇H₂₂N₂O₄ Glycine, *N*-[*N*-(*N*-phenylcarbamylalanyl)valyl]-, 1112¹.
- Glycine, *N*-[*N*-(*N*-phenylcarbamylleucyl)glycyl]-, 2992², 4192³.
- C₁₇H₂₂O Δ^5 -Hendeceneone, 1-phenyl-, 3696².
- C₁₇H₂₂O₂ Citronellol, benzoate, 4187².
- Menthol, benzoate, 2960¹.
- C₁₇H₂₂O₂ Menthol, hydroxybenzoate, 2960¹.
- salicylate, 2960¹.
- C₁₇H₂₂O₁₁ Sequoyitol, pentaacetate, 5469².
- C₁₇H₂₂BrO₂ Santalol, bromoacetate, P 607².
- C₁₇H₂₂NO Benzamide, *N*-[β -(2,2,3-trimethylcyclopentyl)ethyl]-, 4686².
- C₁₇H₂₂NO₂ Anthranilic acid, menthyl ester, -HCl, 2960¹.
- Benzoic acid, amino-, menthyl ester, 2960¹.
- Cyclohexanol, 4-butyl-, carbanilate, 4686².
- 1-Piperidinepropanol, α ,3-dimethyl-, benzoate, -HCl, 602¹.
- 4-Piperidinol, 1-isoamyl-, benzoate, -HCl, 1902².
- C₁₇H₂₂NO₄ Pelargonic acid, θ -hydroxy-, *N*-ester, carbanilate, 1388².
- C₁₇H₂₂NO₃ Camphorsulfonic acid, *p* toluene salt, 3456².
- C₁₇H₂₂N₂O Cyclohexanone, 4-carvacrylsemicarbazone, 5470².
- Mesityl oxide, 4 carvacrylsemicarbazone, 5470².
- C₁₇H₂₂N₂O₄ Cyclohexanone, 4-(*p*-methoxy- α , α -dimethylbenzyl)-, semicarbazone, 6086².
- Piperidine, 1,1'-nitrobenzalbiss-, 5176².
- C₁₇H₂₂N₂O₄ Acetoacetic acid, Et ester, 4-carvacrylsemicarbazone, 5470².
- C₁₇H₂₂N₂O₄ Alanine, *N*-(*N*-leucylglycyl)-*p*-phenyl-, 2992².
- Butyric acid, β -[(*N*-phenylcarbamylleucyl)amino]-, 1389¹.
- , γ -(*N*-phenylcarbamylleucyl)amino-, 1113¹.
- Leucine, *N*-(*N*- β -phenylalanyl)glycyl-, 2992².
- Norvaline, *N*-[α -(β -phenylalaninyl)valeryl]-, 2993².
- Valine, *N*-(*N*-phenylcarbamylvalyl)-, 2993².
- C₁₇H₂₂N₂O₁₁ *d*-Glucose, pentaacetate, semicarbazone, 3904².
- C₁₇H₂₂O₆ Verbenalin, 2501⁴.
- C₁₇H₂₂Br₂N₂ Sparteine dicyanamide, dibromo-*and aurate*, 5187².
- C₁₇H₂₂N₂O₄ 2-Piperidineethanol, 1-propyl-, *p*-aminobenzoate, -HCl, 1902².
- 4-Piperidinol, 1-isoamyl-, *p*-aminobenzoate, -HCl, 1902².
- C₁₇H₂₂N₂S Urea, α -phenylthio β [β -(2,3,4-trimethylcyclopentyl)ethyl]-, 4686².
- C₁₇H₂₂N₂O₄ Cyclohexylamine, *N*,*N*-dimethyl-2-propyl-, picrate, 144¹.
- Cyclohexylamine, *N*-(α -ethylpropyl)-, picrate, 111¹.
- C₁₇H₂₂N₂O₄ α -Ethoxyallyltriethylammonium picrate, 2150⁴.
- C₁₇H₂₂O₂ Acid, b.p. 170-80°, from zinc borane and *N*-CH₃CO₂Et, 3456².
- Δ^1 -Cyclohexeneacrylic acid, 4-isopropenyl-, isoamyl ester, 2248¹, 4942¹.
- C₁₇H₂₂O₂ Cyclobutanecetic acid, 2,3,4-trimethoxy-(?), tetra-Et ester, 3674².
- 1,2,3,4-Cyclopentanetetraacetic acid (tetra-tetra-Et ester, 3674².
- C₁₇H₂₂O₆ Glucoside, tetraacetyl- β -isopropyl-, 1881².

- $C_7H_7ClN_2O_2$ Xanthine, \bullet 1,3,7 tributyl - 8 - chloro-, 3903².
- C_7H_7NO Benzamide, *N*-(γ , γ -dimethyloctyl), 4686¹.
- $C_7H_7NO_2$ Triethylamine, (allyldimethoxyphenoxy)-, P 669², P 4778².
- $C_7H_7NO_2S$ Camphane- ω -sulfonic acid, 2-hydroxy-, *p*-toluidine salt, 3456².
- $C_7H_7NO_2$ Stemonidine, 4221².
- $C_7H_7N_2O_2$ Urea, α , α -disoamyl-, picrate, 344².
- $C_7H_7BrNO_2$ Galactosidotrimethylammonium bromide, tetraacetyl, 3669².
- $C_7H_7BrO_2$ Hiragonic acid, hexabromo-, methyl ester, 5053⁴.
- $C_7H_7N_2O_2$ Leucic acid, diethyl, *p*-aminobenzoate, 3773².
- $C_7H_7N_2O_2$ Xanthine, 1,3,7 tributyl, and III, 3903².
- $C_7H_7O_2$ Isoclovene alcohol, acetate, 4464².
- $C_7H_7O_2$ Kessyl alcohol, acetate, 3455².
- $C_7H_7O_2$ Phthalic acid, cyclohexylisopropyl ester, P 1138², cyclohexyl Et ester, 1138², Et methylcyclohexyl ester, P 1138².
- $C_7H_7BrO_2$ Isovaleric acid, α -bromo α -ethyl ester with borneol, 4191².
- C_7H_7NO α -Curcumenylamine, dihydro-, *N*-deriv., 149².
- $C_7H_7NO_2$ α -Curcumenylamine, dihydro-, acid oxalate, 149².
- $C_7H_7NO_2S$ (Carboxyethoxymethoxyphenethyl)-ethylidimethylammonium methyl sulfate, 2979².
- $C_7H_7NO_2$ Cyclohexanemalonic acid, 1-acetonyl-, di Et ester, semicarbazone, 3672².
- C_7H_7P Phosphine, bis(β -methylbutyl) *p*-tolyl, and $HgCl_2$ compd., 4442².
- Phosphine, diamyl-*p*-tolyl-, and $HgCl_2$ compd., 4442².
- Disoamyl *p*-tolyl, and $HgCl_2$ compd., 4442².
- $C_7H_7AsNO_2$ Dipinacenearsenic acid, pyridine salt, 5961².
- $C_7H_7BrN_2O_2$ Ornithine, *N*, *N'*-bis(α -bromoisocaproyl)-, 1114².
- C_7H_7IP Diamylmethylphenylphosphonium iodide, 4442².
- Disoamylmethylphenylphosphonium iodide, 4442².
- Methylbis(β -methylbutyl) phenylphosphonium iodide, 4442².
- $C_7H_7N_2$ Quinoline, 1-(3-ethyl 2-methyl 1-piperidyl)-1,2,3,4,5,6,7,8-octahydro-, \bullet , and -HCl, 132².
- $C_7H_7NO_2$ Cyclohexanone, 4,4'-isopropylidene bis-, disemicarbazone, 4689².
- C_7H_7O Civetone, 1906², P 4232².
- $C_7H_7BrO_2$ Isovaleric acid, α -bromo α -ethyl ester with menthol, 4194².
- C_7H_7N α -Curcumenylamine, dimethylhydro-, 149².
- $C_7H_7NO_2$ 2-Pyrrolidinecarbinol, 4-hydroxy 1,4-dimethyl- α , β -dipropyl-, diacetate, 4462².
- $C_7H_7ClO_2$ Myristic acid, β , β' -dichloro- ω -propyl ester, 3913².
- $C_7H_7N_2O_2$ Leucine, *N*-[*N'*-(β -aminopropionyl)leucylglycyl]-, 2991².
- C_7H_7O Cycloheptadecanone, 1111², 1906².
- $C_7H_7O_2$ Capric acid, α -(β -cyclopentylethyl)-, P 3543².
- Cyclohexanecundecylic acid, P 848².
- Lauroic acid, α -cyclopentyl-, P 3543².
- Margaric acid, π -hydroxy-, lactone, 1111², P 4483².
- Palmitoleic acid, Me ester, 2422².
- $C_7H_7O_2$ Malonic acid, ethyloctyl-, di-Et ester, 2934².
- Pentadecanoic acid, ξ -hydroxy-, acetate, 3664².
- $C_7H_7BrO_2$ Margaric acid, π -bromo-, 3664².
- C_7H_7N Dodecylamine, μ - Δ^2 cyclopentenyl, and salts, 113², 114², 115².
- C_7H_7 8-Heptadecene, 3659².
- $C_7H_7Cl_2N_2Pt$ Chloroplatinate, m. 185-6°, of base from *N*-cyclohexenyl-1,3-cyclohexanediamine, 1131².
- $C_7H_7N_2O_2$ Ornithine, *N*, *N'*-dileucyl-, 1114².
- $C_7H_7OS_2$ Cetylthioic acid, 4808².
- $C_7H_7O_2$ Cetyl alcohol, formate, 4926².
- Margaric acid, 556², 1549².
- Myristic acid, β , β , α -trimethyl (\bullet), 3702².
- Pelagonic acid, octyl ester, 4926².
- C_7H_7O Imperic acid, Me ester, 3664².
- Margaric acid, π -hydroxy-, 3664².
- C_7H_7O Myristin, α -mono-, 1876².
- Pentadecanoic acid, Et ester, 1108².
- C_7H_7NO Acetamide, *N*-pentadecyl-, 2419².
- C_7H_7O Heptadecanol, 3660².
- C_7H_7N Dodecylamine, *N*, *N*, γ , λ -penta-methyl-, 1926².
- Heptadecylamine, and -HCl, 2418².
- C_7FeN_3Pr Praseodymium ferrocyanide, 4140².
- C_7FeN_3Sm Samarium ferrocyanide, 4139².
- $C_7H_7NO_2S$ Compd., decomps above 280°, from the dipicrate of dimercaptosorcinol, 526².
- $C_7H_7BrN_2O_2S$ Triphenodithiazine-6,13(7,14)-dione, 3,10-dibromo-, 4823².
- $C_7H_7ClN_2O_2S$ Triphenodithiazine-6,13(7,14)-dione, 3,10-dichloro-, 4823².
- $C_7H_7NO_2S$ Resorcinol, 4,6-dimercapto-, dipicrate, 826².
- $C_7H_7BrO_2Se$ Tris(3,5-dibromo-4-hydroxyphenyl)selenonium bromide, 2159².
- $C_7H_7Cl_2O_2S$ Thiondiso, 5,5'-dichloro-3,3'-dimethyl-, P 3177².
- $C_7H_7Cl_2O_2$ γ Pentenic acid, α -chlorobenzoyl- δ -(chlorophenyl)- δ -hydroxy- β -keto-lactone, 3218².
- $C_7H_7ClNO_2$ 2-Anthraquinonecarboxylic acid, 3-hydroxy-4-(trichloroacetamido)methyl-, 2173².
- $C_7H_7Cl_2NO_2$ Quinolone, 5,6,8-trichloro-2-(2,4-dinitrostyryl)-4-methyl-, 4683².
- $C_7H_7NO_2S$ Triphenodithiazine-6,13(7,14)-dione, 4823².
- $C_7H_7N_2O_2S$ Triphenodithiazine-6,13(7,14)-dione, 3,10-dihydroxy-, 4823².
- $C_7H_7O_2$ 1,2-Benzanthrene-5,6-dione, 5472².
- $C_7H_7O_2$ 2,3-Benzofluorene-5-carboxylic acid, 11 keto- \bullet , 5472².
- 6-Chrysofluorene-carboxylic acid, 11 keto (\bullet), 5472².
- $C_7H_7O_2$ 1,2-Benzanthrene-7,12-dione, 5,6-dihydroxy-, 5472².
- C_7H_7O Atomeneic acid, lactone, 1127².
- $C_7H_7BrN_2O_2$ Naphthalic anhydride, bromo-, phenylhydrazine, 2435².
- $C_7H_7BrO_2$ Umbelliferone, 3-acetyl-, *p*-bromobenzoate, 829².
- $C_7H_7BrO_2$ Alizarin, 3-bromo-, diacetate, 2173².
- $C_7H_7Cl_2NO_2$ Quinolone, 5,8-dichloro-2-(2,4-dinitrostyryl)-4-methyl-, 4683².
- $C_7H_7NO_2$ 3,4-Benzacridine-12-carboxylic acid, 3225².
- 1,2 β Naphthazoletione, 3 phenyl-, 3225².

- C₁₈H₁₁NO₄ Naphthalimide, 3,4-dihydroxy-*N*-phenyl-, 4213¹.
- C₁₈H₁₁N₂O₄ Naphthalimide, *N*-nitroanilino-, 4214¹.
- C₁₈H₁₁N₂O₁₀ Quinone, 2,4-dinitrophenylhydrazone, picrylhydrazone, 4670⁶.
- C₁₈H₁₃ Chrysene, 3926².
- C₁₈H₁₃Br₂CuO₄ Acrylophenone, *p*-bromo-*β*-hydroxy-, Cu deriv., 827¹.
- C₁₈H₁₃Br₂Cl₂CuN₂O₂ + 2H₂O 8-Quinolinol, 5,7-dibromo-, complex salt, 51³.
- C₁₈H₁₃Quinolinol, 5,7-dichloro-, complex salt, 51³.
- C₁₈H₁₃Br₂CuI₂N₂O₂ + 2H₂O 8-Quinolinol, 5,7-dibromo-, complex salt, 51³.
- C₁₈H₁₃Br₂O₂Se Tris(3-bromo-4-hydroxyphenyl)-selenonium bromide, 2159².
- C₁₈H₁₃Br₂CuN₂O₂ + 2H₂O 8-Quinolinol, 5,7-dibromo-, complex salt, 51³.
- C₁₈H₁₃Cl₂N₂O₂ 2,5-Piperazinedione, 3,6-bis(*o*-chlorobenzal)-, 5469¹.
- C₁₈H₁₃Cl₂N₂O₄ Anthraquinone, 1,5-diacetamido-4,8-dichloro-, 4944².
- C₁₈H₁₃Cl₂O Ketone, 5,8-dichloro-1-naphthyl *p*-tolyl-, P 4080¹.
- C₁₈H₁₃Cl₂O₈ Coumarin, 3-acetyl-6,8-dichloro-5-hydroxy, *p*-toluenesulfonate, 3219².
- C₁₈H₁₃Cl₂NO₄ Anthraquinone, hydroxymethyl-(trichloroacetamidomethyl)-, 2173⁷.
- C₁₈H₁₃Cl₂CuN₂O₂ + 2H₂O 8-Quinolinol, 5,7-dichloro-, complex salt, 51³.
- C₁₈H₁₃HgN₂ Quinoline, 8,8'-mercuribis-, 2977¹.
- C₁₈H₁₃N₂O [3,2'-Biquinoline]-2-ol-, and salts, 1900².
- C₁₈H₁₃N₂O₂ Naphthalimide, *N*-anilino-, 4214¹.
- C₁₈H₁₃N₂O₂ Naphthalic anhydride, 3,4-dihydroxy-, phenylhydrazone, 4213¹.
- Pseudoisatin, 1,1'-ethylenbis-, 2971¹.
- C₁₈H₁₃N₂O₈ Anhydro-2,3-hydroxynaphthoic-sulfonic-*o*-azobenzyl alcohol, 2163².
- C₁₈H₁₃N₂O₂ 2,5-Piperazinedione, 3,6-bis(*m*-nitrobenzal)-, 5469².
- C₁₈H₁₃N₂O₈ Hydrazine, *β*,*β*-diphenyl-*α*-picryl-, 123⁷.
- C₁₈H₁₃N₂O₄ Quinone, bis(2,4-dinitrophenylhydrazone), 4670⁶.
- C₁₈H₁₃O 1,2-Benzanthren-5-ol, 5472².
- 7-*meso*-Benzanthrenone, 3-*m*q-hyl-, P 1567, P 1143².
- C₁₈H₁₃O₂ 1-Naphthoic acid, 2-benzoyl-, 2707¹.
- C₁₈H₁₃O₄ Anthraquinone, 1,5-diacetyl-, P 5474⁴.
- Anthraquinone, 1-phenylglyoxyl-, P 4949².
- 1-Anthraic acid, 9,10-dihydroxy-2-methyl-, γ -lactone, acetate, 4696².
- Benzofuroin, 4944².
- Naphthoic acid, (*o*-carboxyphenyl)-, 5472⁴.
- α -, hydroxy-, benzoate, 2435⁴.
- C₁₈H₁₃O₆ 1-Anthraquinonecarboxylic acid, 2-methyl-, anhydride with acetic acid, 2711⁴.
- Umbelliferone, acetylbenzoyl-, 8297².
- C₁₈H₁₃O₈ Atromentin, 1127⁴, 1128².
- Phenanthrenequinone, dihydroxy-, diacetate, 3466², 4468².
- C₁₈H₁₃O₇ Atromentic acid, 1128⁴.
- Purpurin, 2,4-diacetate, 4697⁷.
- C₁₈H₁₃O₈ Anthraquinone, 1,2,7,8-tetrahydroxy-, diacetate, 2966⁷.
- C₁₈H₁₃AsBrN Acenaphtho[5,4-*β*]benz[*e*]arsazine, 7-bromo-4,5,7,12-tetrahydro-, 4704².
- C₁₈H₁₃AsClN Acenaphtho[5,4-*β*]benz[*e*]arsazine, 7-chloro-4,5,7,12-tetrahydro-, 4704².
- C₁₈H₁₃Br₂NO₂ Acrylphenone, *β*,*β*'-iminobis[*p*-bromo-, 827¹.
- C₁₈H₁₃ClO₂ Anthradiol, 1-chloro-, diacetate, 2173².
- C₁₈H₁₃ClO₈ Umbelliferone, 3-acetyl-6-chloro-*p*-toluenesulfonate, 3219².
- C₁₈H₁₃Cl₂NO₂ Acrylophenone, *β*,*β*'-iminobis[*p*-chloro-, 827¹.
- C₁₈H₁₃IO₄ 2,10-Anthradiol, 3-iodo-, diacetate, 2173².
- C₁₈H₁₃NO 1,2-Benzanthren-5-ol, 6-amino-, 5472².
- Compd., m. 223-4°, 4218².
- C₁₈H₁₃NO₂ Δ^2 -1-Propenone, 1-(2-hydroxy-3-picolyl)-3-phenyl-, 1900².
- C₁₈H₁₃NO₂ Cinnamic acid, *β*-benzoyl-*α*-cyano-Me ester, 2946².
- C₁₈H₁₃NO₂ Phenanthrenequinone, 4-(diacetyl-amino)-3-hydroxy-, 3466².
- C₁₈H₁₃NO₂ Naphthalic acid, sulfo-, anthracene, 2435^{2,5}.
- C₁₈H₁₃N₂O₄ Quinoline, 2-(2,4-dinitroethyl)-, methyl-, 4682².
- C₁₈H₁₃N₂O₈ Acrylophenone, *β*,*β*'-iminobis[*n*-nitro-, 827¹.
- C₁₈H₁₃N₂O₈ Hydrazine, α , α -diphenyl-*β*-picryl-, 123⁷.
- C₁₈H₁₃N₂O₈ Pyridine, 3-*p*-nitrobenzyl-, picrate, 2976¹.
- C₁₈H₁₃N₂O₈ Quinone, 2,4-dinitrophenylhydrazone, nitrophenylhydrazone, 4670⁶.
- C₁₈H₁₄ 2,4-Hexadiene, 1,6-diphenyl-, 2930².
- C₁₈H₁₄AgNO₄ Malonic acid, cyano-, dibenzyl ester, Ag deriv., 4193².
- C₁₈H₁₄Br₂NO₂ Thyroxine, α -bromopropionyl-, 1632¹.
- C₁₈H₁₄CdN₂O₄ Pyridine, 2-(2-pyrryl)-, Cd compd., 4698².
- C₁₈H₁₄Cl₂NO₂ Thyroxine, chloroacetyl-, Me ester, 1632¹.
- C₁₈H₁₄Cl₂N₂O₂ 2-Naphthol, 1-(dichloro-*p*-phenylethylazo)-, 3910⁴.
- C₁₈H₁₄KNO₄ Malonic acid, cyano-, dibenzyl ester, K deriv., 4193².
- C₁₈H₁₄NaO₄ Malonic acid, cyano-, dibenzyl ester, Na deriv., 4193².
- C₁₈H₁₄N₂O₂ Acetophenone, *p*-(2-hydroxy-1-naphthylazo)-, 3461².
- Phthalimide, *N*-(β -3-indylethyl)-, 2419².
- C₁₈H₁₄N₂O₈ Thiazole, 2-dibenzoylamino-1-methyl-(?), 2177².
- C₁₈H₁₄N₂O₂ Carbamic acid, 2-phenylcinchoninyl-, Me ester, P 4778¹.
- C₁₈H₁₄N₂O₄ 2-Naphthoic acid, 3-hydroxy-4-*o*-hydroxy-*o*-tolylazo-, 2163².
- C₁₈H₁₄N₂O₂ Benzaldehyde, *o*-(β -cyano-3,4-dimethoxy-2-nitroethyl)-, 5186².
- C₁₈H₁₄N₂O₄ 5(4)-Oxazolone, 4-(3,4-dimethoxy-2-nitrobenzal)-2-phenyl-, 2980⁷.
- C₁₈H₁₄N₂Ni Pyridine, 2-(2-pyrryl)-, Ni compd., 4698².
- C₁₈H₁₄N₂O₂ 2,2'-Bibenzimidazole, diacetyl-, 380².
- C₁₈H₁₄N₂O₈ Carbanilic acid, *N*-acetyl-*m*-nitrodithio-, anhydride with *N*-acetyl-*m*-nitrocarbanilic acid, 2953¹.
- C₁₈H₁₄N₂O₈ Isoquinoline, 1-ethyl-6,7-methylene-dioxy-, picrate, 2444².
- C₁₈H₁₄N₂O₄ 1,3,5-Benzenetriamine, 2,4,6-trinitro-*N*¹, *N*²-diphenyl-, 2428².
- C₁₈H₁₄N₂O₁₁ 1-Naphthylamine, *N*, *N*-dimethyldinitro-, picrate, 4467¹.
- C₁₈H₁₄O 1-Indanone, 2-cinnamal-, 2710².
- Phenol, 3,5-diphenyl-, 2156².

- $C_{18}H_{16}O_2$ Ketone, 3-hydroxy-2-naphthyl tolyl, P 2187¹.
Ketone, 4-methoxy-1-naphthyl phenyl, 832².
 $C_{18}H_{16}O_2$ Cyclopentadienone, 3 - hydroxy - 4 - methoxy-2,5-diphenyl-, 1128⁴.
Ketone, anisyl hydroxy - 2 - naphthyl, P 2187^{4,5}.
 γ -Pentenic acid, γ -hydroxy- β -methoxy- α , δ -diphenyl-, lactone, 1128⁶.
 $C_{18}H_{16}O_2$ 2,10-Anthradiol, diacetate, 2173¹.
1-Anthraquinonecarboxylic acid, 2-methyl-, Et ester, 4696².
Malonic anhydride, α - phenacylbenzyl -, 3210⁷.
 γ Pentenic acid, δ hydroxy- β -(3,4-methylene dioxyphenyl)- δ -phenyl-, lactone, 3210⁸.
Phenanthrenediol, diacetate, 3466³, 4468⁹.
 $C_{18}H_{16}O_2$ Anthraquinone, 1-hydroxy-2-methoxy- δ -methyl-, acetate, 2174⁹.
 $C_{18}H_{16}O_2$ Anthraquinone, 3 - hydroxy - 1,2 - dimethoxy-, acetate, 4697⁴.
Benzofuranone, benzaldihydroxy-, ethylcarbonate, 4698².
-, hydroxy(p -hydroxyphenyl)-, diacetate, 2714⁴.
 $C_{18}H_{16}O_7$ 2-Anthraquinonecarboxylic acid, 3,5,6-trimethoxy-, 4214¹.
Pyromucic acid, tetrahydro-2- p -hydroxybenzyl-3-(p -hydroxyphenyl)-4,5-diketo-, 1128².
 $C_{18}H_{16}BrO_8S$ Thioxanthone, 1 - hydroxy - 4 - methoxy-, diacetoborate, 4472².
 $C_{18}H_{16}BrO_8Se$ Tris(p -hydroxyphenyl)selenium bromide, 2159².
 $C_{18}H_{16}ClN_2O$ Cinchoninanilide, 2 - chloro - N -ethyl-, P 1217².
 $C_{18}H_{16}ClN_2O_2$ 5(4)-Isoxazolone, 3 (chlorophenyl)-4- p -dimethylaminobenzal-, 3218⁹, 3219¹.
 $C_{18}H_{16}ClO_8Se$ Tris(p -hydroxyphenyl)selenium chloride, 2159¹.
 $C_{18}H_{16}ClO_8Si$ Silicane, chlorotriphenoxy-, 4457⁴.
 $C_{18}H_{16}ClO_8Se$ Tris(2,4-dihydroxyphenyl)selenium chloride, 2159².
 $C_{18}H_{16}ClPb$ Plumbane, chlorotriphenyl-, 5470⁸.
 $C_{18}H_{16}ClSn$ Stannane, chlorotriphenyl-, 5172².
 $C_{18}H_{16}ClP$ Phosphine, triphenyl-, dichloride, 2158².
 $C_{18}H_{16}Cr$ Chromium triphenyl, 787¹.
 $C_{18}H_{16}I_2NO_6$ Thyroxine, N -lactyl-, 1632¹.
 $C_{18}H_{16}KO_6$ Compd., m. 170.5°, from o -AcOC₆H₄CO₂H and o -AcOC₆H₄CO₂K, 4776².
 $C_{18}H_{16}NO_8$ 1,1'-Bithionaphthene, 2-acetamido-1,2-dihydro-, 3468⁹.
 $C_{18}H_{16}NO_2$ Cinchophen, 6,8-dimethyl-, 2215¹.
2-Naphthamide, benzyloxy-, P 2188⁹, P 2190¹.
 p Toluic acid, α -benzal- α -cyano-, Et ester, 2176⁹.
 $C_{18}H_{16}NO_2$ Acetamide, N - (hydroxyphenanthryl)-, acetate, 3465⁹, 3466⁹.
Cinchophen, 4'-methoxy-6(7 and 8)-methyl-, 2215^{1,2}.
Compd., m. 152°, from Me β -benzoyl- α -cyanohydrocinnamate, 2946⁴.
Hydrocinnamic acid, β -benzoyl- α -cyano-, Me ester, 2946⁴.
 $C_{18}H_{16}NO_4$ Malonic acid, cyano-, dibenzyl ester, 4193³.
 $C_{18}H_{16}NO_4$ p -Toluic acid, α -anisal- α -cyano-, Me ester, 2176⁹.
 $C_{18}H_{16}N_2O$ Acetophenone, p -(4-amino-1 naphthylazo)-, 3459⁷.
 $C_{18}H_{16}N_2O_2$ Acetophenone, p -(2-hydroxy-1-naphthylazo)-, oxime, 3461⁸.
Pyrazo[5,4- γ]quinoline-1,4(2,5)-dione, 3-ethyl-2-phenyl-, 2443⁸.
 α - Toluamide, o - (hydroxynaphthylazo) -, 4700³.
 $C_{18}H_{16}N_2O_4$ 4(3)-Quinazolone, 3-diacetyl-amino-2-phenyl-, 836¹.
 $C_{18}H_{16}N_2O_5S_2$ 2-Naphthol, 3,6 bis(methylmercapto)-1-(p nitrophenylazo)-, 1129⁹.
 $C_{18}H_{16}N_2O_6$ Naphthylamine, N , N -dimethyl-nitro-, picrate, 4166^{7,8,9}.
 $C_{18}H_{16}P$ Phosphine, triphenyl-, 2158^{2,3}.
 $C_{18}H_{16}Pb$ Lead triphenyl, 1888⁶.
 $C_{18}H_{16}S_8b$ See *Sulfoform*.
 $C_{18}H_{16}AgN_2O_2$ p Malonaniside, α -cyano-, Ag deriv., 4193⁷.
 $C_{18}H_{16}AsNO_4$ o -Arsanilic acid, N -3-acenaphthyl-, 4704¹.
 $C_{18}H_{16}AsN_2O_2$ 1,4-Benzisoxazin-3-ol, 6,6'-arsenobis[8-methyl-, 841⁹.
 $C_{18}H_{16}BrI_2NO_3$ Alanine, β [4-(p -hydroxyphenoxy)-3,5-diiodophenyl]-, α -bromopropionyl deriv., 1632¹.
 $C_{18}H_{16}Br_2CoN$ Diquinolinium cobaltous bromide, 5125¹.
 $C_{18}H_{16}ClI_2NO_3$ Alanine, β [4-(p hydroxyphenoxy)-3,5-diiodophenyl], Me ester chloroacetyl deriv., 1632¹.
 $C_{18}H_{16}Cl_2O_3$ Acetophenone, oxybis[α -chloro- ar -methoxy-, P 396¹, P 393¹.
 $C_{18}H_{16}Cl_2CoN$ Diquinolinium cobaltous chloride, 5125^{2,3}.
 $C_{18}H_{16}Cl_3NO_3$ Rhamnose, 2,1,6 trichlorophenyl- α -osazone, 4679⁹.
 $C_{18}H_{16}Cl_3NO_3$ Fructose, 2,4,6-trichlorophenyl- α -osazone, 4679⁹.
Galactose, 2,4,6 - trichlorophenyl- α -osazone, 4679⁹.
Glucose, 2,4,6 - trichlorophenyl- α -osazone, 4679⁹.
 $C_{18}H_{16}CoI_2N$ Diquinolinium cobaltous iodide, 5125¹.
 $C_{18}H_{16}IN_2O_3$ Pyrazo[4,5- γ]quinolin - 4 - ol, 3-methyl-1-phenyl-, methiodide, 1900¹.
 $C_{18}H_{16}I_2NO_3$ Thioxine, alanyl-, 1632¹.
 $C_{18}H_{16}N_2O$ Barbituric acid, 5,5-dibenzyl-, 3024¹.
Barbituric acid, 5-ethyl-1,3-diphenyl-, 3024¹.
Malonamide acid, α -benzyl- α -cyano-, Me ester, 4193⁶.
Oxazolidine, 3,5 benzoyl-2 - benzoylimino - 5-methyl-(?), 2177².
 Δ^2 -Oxazoline, 2-dibenzoylamino-5-methyl-(?), 2177².
 $C_{18}H_{16}N_2O_4$ 2 Indolecarboxylic acid, 1-methyl-3-(o -nitrophenyl)-, Et ester, 4699².
 $C_{18}H_{16}N_2O_5S_2$ 1 - Phenol - 2,4 - disulfonanilide, 1630².
 $C_{18}H_{16}N_2O_7$ Cinnamic acid, α -benzamido-3,4-dimethoxy-2-nitro-, 2980⁹.
 $C_{18}H_{16}N_2O_9$ 1,2-Propanediol, 3-methoxy-, bis(p -nitrobenzoate), 818².
 $C_{18}H_{16}N_2O_8S_4$ + H₂O 2-Naphthol-3,6 disulfonic acid, xyllylazo-, acid sulfate, *tri-Na salt*, 3462⁹.
 $C_{18}H_{16}N_2O_8$ Δ^1 -2-Hexadienone, 6-phenyl, 2,4-dinitrophenylhydrazine, 2966¹.
 $C_{18}H_{16}N_2O_8S_4$ 1,3,4 - Thiazine, 6 - ethoxy - 2 - phenyl-, picrate, 840⁸.
 $C_{18}H_{16}N_2O_8$ Isoquinoline, 6,7 - dimethoxy - 1 - methyl, picrate, 2444¹.
Isoquinoline, 1 - ethyl - 3,4 - dihydro - 6,7 - methylenedioxy-, picrate, 2444².
 $C_{18}H_{16}N_2O_8S_2$ Acetic acid, bis[4,5-dihydro-1-phenyl - 5 - thioketo - 1 - (1,2,3,4 -

- tetra-*zyl*)-, Et ester, 4470⁹.
 Acetic acid, bis[1 - phenyl - 5 - (1, 2, 3, 4 - tetra-*zyl*)mercapto]-, Et ester, 4470⁹.
 C₁₂H₁₀O Δ²-Cyclohexenone, 3, 5-diphenyl-, 2156¹, 3674⁷.
 C₁₂H₁₀O₂ 1-Anthric acid, 2-methyl-, Et ester, 4696⁷.
 C₁₂H₁₀O₂ Isoflavone, 7-methoxy-2, 5-dimethyl-, 2180⁹.
 Δ²-4, 1-Pentadienone, 5-*p*-anisyl-1-(*p*-hydroxyphenyl)-, 3911⁹.
 C₁₂H₁₀O₂ β-Butenic acid, α-(α-hydroxybenzyl)-*γ*-phenyl-, formate, 1395².
 Cinnamic acid, *p*-methoxy-, phenacyl ester, 2432².
 Glutaric acid, β-diphenylmethylene-, 5181².
 β-Hydromuconic acid, α, δ-diphenyl-, 5181².
 Truxillic acid, 2945⁹.
 Truxinic acid, 2945⁹.
 Valeric acid, δ-hydroxy-β-(3, 4-methylenedioxyphenyl)-δ-phenyl-, lactone, 3211².
 C₁₂H₁₀O₂ Acetophenone, 2, 4 - dihydroxy - α - phenyl-, diacetate, 833¹.
 Anthraquinone, trimethoxymethyl-, 3464⁸.
 Butyric acid, γ-benzoyl-β-(3, 4-methylenedioxyphenyl)-, 3210⁹.
 Δ²-2, 4-Hexenedione, 6-(4-hydroxy-1-naphthyl)-, methylcarbonate, 4211⁹.
 Homopteroic acid, acetyldemethyl-, 2246¹.
 Isoflavone, 4', 5, 7-trimethoxy-, 2180⁹.
 Sesamin, 3911⁹.
 C₁₂H₁₀O₂ Chrysin, 2', 3, 4'-trimethoxy-, 2181².
 Des-*N*-trilobinedicarboxylic acid, 393².
 C₁₂H₁₀O₂ Des - *N* - tetradrineketodicarboxylic acid, 4475⁹.
 Flavone, 3, 5, 7 - trihydroxy - 3', 4', 5' - trimethoxy-, 2481².
 Iridigin, 2718¹.
 C₁₂H₁₀Si Silicane, triphenyl-, 2954⁸, 5470⁸.
 C₁₂H₁₀BrO Chalcone, α - bromo - β - propoxy -, 4941².
 C₁₂H₁₀ClO₂ β-Butenic acid, α-(α-chlorobenzyl)-*γ*-phenyl-, Me ester, 1396².
 C₁₂H₁₀ClO₂ 2', 4', 6'-Trimethoxyflavylium chloride, and FeCl₃ deriv., 5183².
 C₁₂H₁₀Cl₂FeO₂ 2', 4', 6' - Trimethoxyflavylium chloride, FeCl₃ deriv., 5183².
 C₁₂H₁₀IN₂O 3, 4-Dihydro-3-keto-1, 4-dimethyl-2, 5-diphenyl-1-pyrazinium iodide, 602².
 C₁₂H₁₀N Quinoline, 4-ethylmethyl-2-phenyl-, 2443⁴.
p-Toluidine, *N*-(*p*-phenyl-Δ²-4-pentadienylidene)-, 3688¹.
 C₁₂H₁₀N₂O Aniline, *N* - (α - *p* - anisyl - Δ² - 4-pentadienylidene)-, 3912¹.
 Quinoline, 4-ethylmethoxy-2-phenyl-, 2443⁴.
 C₁₂H₁₀N₂O₂ α, γ-Pentadienanilide, δ-*p*-anisyl-, 3912².
 C₁₂H₁₀N₂O₂ Acetamide, *N*-(9, 10-dimethoxy-2-anthryl)-, P 607⁸, P 1418².
 Desmethyltribolinol, and *H* Br, 393².
 C₁₂H₁₀N₂O₂ Butyramide, γ - benzoyl - β - (3, 4-methylenedioxyphenyl)-, 3210⁹.
 Cinnamic acid, *p*-methoxy-, phenacyl ester, oxime, 2432².
 3-Isophenoxazone, 4-hydroxy-2-isopropyl-5-methyl-, acetate, 1895⁹.
 Malonamic acid, α - (α - phenacylbenzyl) -, 3210⁹.
 C₁₂H₁₀N₂O₂ 2, 6-Morpholinedicarboxylic acid, 3, 5-diphenyl-, P 2723⁷.
 C₁₂H₁₀N₂O₂ 1, 3-Propanediol, 2-(hydroxymethyl)-2-nitro-, dibenzoate, 4927⁴.
 C₁₂H₁₀N₂O 2-Naphthylamine, 3, 4-dihydro-*N*-methyl - 4 - methylimino - *N* - nitroso - 3 - phenyl-, 4467².
 C₁₂H₁₀N₂O₂ Thiazole, phenyl(β-tolylhydrazino)-, acetyl deriv., 1410¹, 4.
 Δ²-Thiazoline, 2-imino-4-phenyl-3-*p*-toluino-, acetyl deriv., 1410⁹.
 C₁₂H₁₀N₂O₂ Malonanilide, α-cyano-*N*, *N'*-di-methyl-, 4193⁷.
 Malonotoluide, cyano-, 4193⁷.
 Δ²-1-Pyrazolinedicarboxamide, 5-keto-4-phenylethyl-3-phenyl-, 1395².
 1, 3, 4-Triazole-1-*o*-benzoic acid, 2-methyl-*p*-phenyl-, Et ester, 836¹.
 C₁₂H₁₀N₂O₂ Δ²-5-Pyrazolinedicarboxylic acid, 3-phenyl - 1 - phenylcarbamyl -, Me ester, 3704⁸.
 C₁₂H₁₀N₂O₂ *p*-Malonanilide, α-cyano-, 4193⁷.
 C₁₂H₁₀N₂O₂ Phthalazine-4-acetic acid, 1-hydroxy - 3 - (3' - nitrophenyl) - 1, 3 - dihydro-, Et ester, 146¹.
 C₁₂H₁₀N₂O₂ Benzophenone, 2-hydroxy-5, 5'-di-nitro-2'-(1-piperidyl)-, 2182².
 Cinnamaldehyde, dimethoxymethylenedioxy-, *p*-nitrophenylhydrazone, 4940⁷.
 C₁₂H₁₀ Biphenyl, *p*, *p'*-diallyl-, 3908¹.
 Biphenyl, *p*, *p'*-dipropenyl-, 3908¹.
 Retene, 2175¹, 4464⁴.
 C₁₂H₁₀BrClN₂S 5-Chloro-1-(*p*-dimethylaminostyryl) - 2 - methylbenzothiazolium bromide, 390⁹.
 C₁₂H₁₀BrNO₂ Alanine, *N*-(α-bromohydroxyamyl)-β-phenyl-, 2992⁹.
 C₁₂H₁₀Br₂N₂O₂ *d*-Glucose, 2, 4 dibromophenyl osazone, 1400⁸.
 C₁₂H₁₀Cl₂N₂O₂ Rhamnose, 2 - chloro - 4 - nitrophenyl osazone, 4679⁹.
 C₁₂H₁₀Cl₂N₂O₂ Fructose, 2-chloro-4-nitrophenyl osazone, 4679⁹.
 Galactose, 2-chloro-4-nitrophenyl osazone, 4679⁹.
 Glucose, 2-chloro-4-nitrophenyl osazone, 4679⁹.
 C₁₂H₁₀Cl₂N₂O₂ Rhamnose, 2, 4 - dichlorophenyl osazone, 4679⁹.
 C₁₂H₁₀Cl₂N₂O₂ Fructose, 2, 4 - dichlorophenyl osazone, 4679⁹.
 Galactose, 2, 4-dichlorophenyl osazone, 4679⁹.
 Glucose, 2, 4-dichlorophenyl osazone, 4679⁹.
 C₁₂H₁₀I₂N₂O₂ Alanine, β-[4-(*p*-hydroxyphenoxy)-3, 5-diiodophenyl]-, alanyl deriv., 1672².
 C₁₂H₁₀I₂N₂O₂ + 2H₂O, 1361⁷.
 C₁₂H₁₀N₂ 1, 3-Naphthylenediamine, *N*, *N'*-dimethyl-2-phenyl-, 4467².
 Pyrazole-, 4-ethyl-1-methyl-3, 5-diphenyl-, 4701¹.
 C₁₂H₁₀N₂O α, γ-Pentadienaldehyde, δ, *p*-anisyl-phenylhydrazone, 3912¹.
 C₁₂H₁₀N₂O₂ *p* - Phenylenediamine, *N*, *N'*-dimethyl - *N'* - (3, 4 - methylenedioxybenzyl)-, and sulfate, 379⁹.
 2, 5-Piperazinedione, 1, 4-dibenzyl-, 810⁹.
 C₁₂H₁₀N₂O₂ 2-Oxazolidone, 5-(benzylmercapto-methyl) - 3 - (phenylthiocarbamyl) -, 2177⁴.
 C₁₂H₁₀N₂O₂ Homoterephthal-1-amic acid, α-(*p*-dimethylaminobenzyl)-, and Ba salt, 2176⁹.
 C₁₂H₁₀N₂O₂ Alanine, *N* - hippuryl - β - phenyl-, 1112².
 Benzoic acid, 2-(*p*-dimethylaminostyryl)-5-nitro-, Me ester, 2166⁴.
 Compd., m. 124-5°, from 2-nitro-*N*-phenylethylhomoveratramide, 2981⁴.

- Glutaconic acid, β -benzyl- α , γ -dicyano, di Et ester, 4685⁷.
- Isoquinoline, 3,4-dihydro-1-(2-nitro-veratryl)-, 2981³.
- $C_{15}H_{16}N_2O_{10}S_2$ Anthraquinonedisulfonic acid, bis(dimethylamino)dihydroxy-, P 1419⁸.
- $C_{15}H_{14}N_2O_8$ Benzamide, *N*, *N'*-butylenebis[*m* nitro-, 1874⁶.
- Benzamide, *N*, *N'*-(*as*-dimethylethylene)bis[*m*-nitro-, 1874⁷.
- , *N*, *N'*-(2-methyltrimethylene)bis[*m* nitro-, 1874⁷.
- $C_{15}H_{11}N_4O_8$ Bimesityl, tetranitro, 1406¹.
- $C_{15}H_{11}N_4O_8$ Isoquinoline, 3,4-dihydro-6,7-di-methoxy-1-methyl-, picrate, 2441¹.
- $C_{15}H_{11}N_6$ Quinonedimine, *N*, *N'*-bis(2,5-diaminophenyl)-, 2962⁷.
- $C_{15}H_{11}N_3S$ 1,2,4-Triazole, 3-[β -allylthiocarbamido]-5-amino-1-phenyl-, 2177⁹.
- Urea, α -[5-(allylamino)-1-phenyl-3-1,2,4-triazolyl]- β -phenylthio-, 1640⁷.
- $C_{15}H_{11}N_6O_{11}$ Glycocyamine, 5- γ aminopropyl)-, dipicrate, 1621⁸.
- $C_{15}H_{15}O$ Cyclohexanone, 3,5-diphenyl-, 2157.
- 1-Indanone, 2-(γ -phenylpropyl)-, 2710¹.
- $C_{15}H_{11}O_2$ Acrylic acid, β -phenyl β β tolyl-, Et ester, 2706⁷.
- 1,4-Pyrone, tetrahydro-3-methyl-2,6-diphenyl-, 4171⁴.
- $C_{15}H_{11}O_3S$ Acetophenone, α , α' -thio[*p*-methyl-, 1629⁷.
- $C_{15}H_{11}O_3$ Cinnamic acid, α benzyl *p* methoxy-, Me ester, 2959⁷.
- Cinnamic acid, α -(*p*-methoxybenzyl)-, Me ester, 2959⁷.
- Des-*N* tetrandrine, 4475⁷.
- $C_{15}H_{11}O_4$ Acetophenone, 4-hydroxy 2-methoxy α methyl- α -phenyl-, acetate, 2180.
- Cinnamic acid, *p*-methoxy α *p* methoxybenzyl-, 1128³.
- Malonic acid, benzylmethylbenzyl-, 2706⁹.
- Phenanthrene, 2,3,5,6-tetramethoxy-, 3710¹.
- 1,3-Propanedione, 1-*p*-anisyl-3-*p* phenetyl-, 125⁸.
- Valeric acid, β -(3,4-methylenedioxyphenyl) δ phenyl-, 3211⁴.
- $C_{15}H_{11}O_5S_2$ Benzoic acid, *m*, *m'* trithiobis-, di Et ester, P 1137³.
- $C_{15}H_{11}O_5S_2$ Benzoic acid, *m*, *m'* tetrathiobis-, di Et ester, P 1137³.
- $C_{15}H_{11}O_6$ Chalcone, 2-hydroxy-2',4',6'-tri-methoxy-, 5183⁹.
- Kikokunetin, di-Me deriv., 2717¹.
- Propiophenone, 4-ethoxy 2-hydroxy β (3,4-methylenedioxyphenyl)-, 125⁸.
- $C_{15}H_{11}O_6$ Diphenic acid, 3,3'-dimethoxy-, di Me ester, 129⁸.
- Flavanone, 5-hydroxy-3',4',7-tri-methoxy-, 4210⁹.
- $C_{15}H_{11}O_7$ Des-*N*-tetrandrinedicarboxylic acid, 4475⁷.
- $C_{15}H_{13}BrN_2O_2$ Benzamide, *N*-*p*-bromobenzyl *N*-(ethylcarbamylmethyl)-, 840⁸.
- $C_{15}H_{19}IN_2O_4$ 5-Acetamido-2,8-dimethoxy 10-methylacridinium iodide, 1904¹.
- $C_{15}H_{19}NO$ Cyclohexanone, 3,5-diphenyl-, oxime, 2157¹.
- Indoline, 1-acetyl-3,3-dimethyl-2-phenyl-, 3927⁷.
- $C_{15}H_{19}NO_2$ (See also *Apocodine*.)
- p*-Cinnamotoluide, *p*-ethoxy-, 1396⁹.
- Indoline, 1-benzoyl-2-methoxy-3,3-di-methyl-, 3927⁷.
- p*-Phenetidine, *N*-*p*-methoxycinnan-3911⁸.
- $C_{15}H_{19}NO_2$ (See also *Curine*.)
- p*-Cinnamaniside, *p*-ethoxy-, 1396⁹.
- Isochondrodendrine, 4222⁵.
- Isovaleramide, *o*-hydroxy-, benzoate, 4940⁸.
- Isovaleric acid, *o*-benzamidophenyl ester, 4940⁸.
- Phenol, 5-allyl-2-ethoxy-, carbanilate, 1890⁹.
- , 2-ethoxy 5-propenyl-, carbamate, 1890².
- Valeramide, *o*-hydroxy-, benzoate, 4940¹.
- Valeric acid, *o*-benzamidophenyl ester, 4940².
- $C_{15}H_{19}NO_2$ Acetylmalaphenylammonium acetate, 2971⁸.
- Anhydrocodzone, 1644².
- Carbamie acid, *o*-hydroxy-, Bu ester, benzoate, 4910⁸, isobutyl ester, benzoate, 1940⁸.
- $C_{15}H_{19}NO_2$ Thebaizone acid, 1642⁹.
- $C_{15}H_{19}NO_2$ Thebaizonedicarboxylic acid, 1642⁹.
- $C_{15}H_{19}NO_3$ 1-Indanone, 2-benzyl 5-methyl-, semicarbazone, 2706⁸.
- 1-Indanone, 2-*p*-methylbenzyl-, semicarbazone, 2706⁸.
- 1,2-Naphthalenone, 3,1-dihydro-4-*p* tolyl-, semicarbazone, 2709⁸.
- $C_{15}H_{19}N_2O_8S$ Oxazolidine, 5 (benzylmercaptomethyl)-2-imino-3-(phenylthiocarbonyl)-, 2177⁹.
- Δ^2 -Oxazoline, 5-(benzylmercaptomethyl)-2- β phenylthiocarbonyl-, 2177⁹.
- $C_{15}H_{19}N_2O_2$ Homoterephthalamide, α β di-methylaminobenzal(-)-, 2176⁸.
- $C_{15}H_{19}N_2O_8S$ *p*-Toluenesulfonotoluide, 2-(1,5-dihydro-5-keto-3-methyl-1-pyrazolyl)-, 3909⁸.
- $C_{15}H_{19}N_2O_3$ Alanine, β phenyl-*N*-(*N*-phenylcarbamylglycyl)-, 1112⁷.
- 1-Phthalazincacetic acid, 2-(*m* aminophenyl)-1,2,3,4-tetrahydro-1-hydroxy-, acetyl deriv., 1461¹.
- Pyruvic acid, (*o*-nitrophenyl)-, Et ester, methylphenylhydrazine, 4699⁸.
- $C_{15}H_{19}N_2O_8S$ *p*-Toluenesulfon-*o*-aniside, 2-(1,5-dihydro-5-keto-3-methyl-1-pyrazolyl)-, 3909⁸.
- $C_{15}H_{19}N_2O_8$ Acetoacetic acid, γ phenoxy-, Et ester, *p*-nitrophenylhydrazine, 4481¹.
- $C_{15}H_{19}N_2O_8$ Aniline, *N*, *N*-dimethyl *p* phenyl-azo-, oxalate, 4200¹.
- $C_{15}H_{19}N_2O_8$ Benzyl alcohol, (annuomethyl)-, picrolonate, 3051⁸.
- $C_{15}H_{19}N_2O_8$ Indoline, 1-acetyl-2-amino-3,3-dimethyl-, picrate, 3927⁷.
- $C_{15}H_{19}Br_2$ Bimesityl, 3,3'-dibromo-, 1406¹.
- $C_{15}H_{19}Br_2N_2O_2$ Altromethylose, *p* bromophenyl osazone, 2940⁸.
- Fucose, *p*-bromophenylosazone, 2940⁸.
- $C_{15}H_{19}ClNO_2$ Toluidine, *N*-(5-chlorovanilla)-5-isopropyl-, 4156⁶.
- $C_{15}H_{19}ClNO_2$ Codemone, chlorodihydro-, and -HCl, 4778⁸.
- $C_{15}H_{19}ClNO_2$ Codzone, chloro-, and -HCl, 1644¹.
- $C_{15}H_{19}Cl_6N_2PtS$ 1,2-Dimethylbenzothiazolium chloroplatinate, 142⁶.

- C₁₅H₂₀Cl₆N₂PtSe₂ 1, 2 - Dimethylbenzoselenazolum chloroplatinate, 142⁷.
- C₁₅H₂₀N₂O₂ Benzamide, *N*-benzyl-*N*-(ethylcarbamylmethyl)-, 840⁴.
- Cinchoninamide, *N*, *N*-diallyl-2-ethoxy-, P 1217⁸.
- Quinazoline, 6-ethoxy-3,4-dihydro-3-*p*-phenetyl-, 3929⁴.
- C₁₅H₂₀N₂O₂S Acetophenone, α, α' -thiobis[*p*-methyl-, dioxime, 1820⁷.
- C₁₅H₂₀N₂O₂S₂ Propionanilide, *o, o'*-dithiobis-, 142⁹.
- C₁₅H₂₀N₂O₂Se₂ Acetamide, *o, o'* diselenobis[*N*-methyl-, 142⁷.
- C₁₅H₂₀N₂O₂ Alanine, β -phenyl-*N*- β -phenylalanyl-, 2092⁷.
- C₁₅H₂₀N₂O₂S₂ *p, p'*-Bicarbanilic acid, thiono-, di Et ester, 2953⁷.
- C₁₅H₂₀N₂O₄ Bimesityl, 3,3'-dinitro-, 1406⁹.
- Tyrosine, *N*- β -phenylalanyl-, 2726⁷.
- C₁₅H₂₀N₂O₂S₂ Alanine, dithiobis[phenyl-, 3941⁷.
- C₁₅H₂₀N₂O₄ Glutaconic acid, β -benzyl- α -carbamyl- γ -cyano-, di-Et ester, 4685⁷.
- Homoveratramide, 2-nitro-*N*-phenethyl-, 2981⁴.
- Propanediol, methoxy-, dicarbanilate, 818².
- C₁₅H₂₀N₄ 1,2-Cyclohexanedione, phenylsazone, 2439⁷.
- C₁₅H₂₀N₂O₁₀ Homopiperonyl alcohol, α -(dimethylaminomethyl)-(-)-, picrate, 4683⁷.
- Piperonyl alcohol, α -(α -ethylaminoethyl)-, picrate, 2162⁴.
- 1-Propanol, 2-dimethylamino-3-(3,4-methylenedioxyphenyl)-(-), picrate, 4683⁷.
- C₁₅H₂₀N₄S₂ 1,3,4-Thiadiazole, 2,5-bis[*N*-ethyl anilino]-, 1900¹.
- C₁₅H₂₀N₄S₂ 1,4-Piperazinedicarboxanilide, dithio-, 2178¹.
- C₁₅H₂₀O Cyclohexanol, 3,5-diphenyl-, 2157¹.
- Ethylene oxide, α -benzyl β phenyl α propyl-, 2058⁹.
- 3-Hexanone, 1,6-dimethyl-, 2935¹.
- Propiophenone, 2,4,5-trimethyl β phenyl-, 125⁴.
- C₁₅H₂₀O₂ Benzophenone, 2 isopropyl 1 methoxy-5-methyl-, 1123³.
- Compd., m. 181^o, from isopropylidenethoxyphenol, 4689⁷.
- Phenol, cyclohexylidenebis-, 1729².
- Valeric acid, α -benzyl β -phenyl-, 2710¹.
- C₁₅H₂₀O₂ Compd., m. 186^o 7^o, from methiodide of the Me ether of *d* heberine, 147⁹.
- Hydracrylic acid, α -phenethyl β phenyl-, Me ester, 1396¹.
- Phenol, *m*-isoamoxy-, benzoate, 1131².
- Propiophenone, β -(3-methoxy-*p*-phenetyl)-, 125⁴.
- C₁₅H₂₀O₂ Homopterocarpin, dihydro-, Me ether, 2246¹.
- Propiophenone, β -*p*-anisyl 3,4-dimethoxy-, 125⁴.
- C₁₅H₂₀Br₂N₂O₄ 4-Isopyrrolecarboxylic acid, 2-[(5-bromo-3-carboxy-4-methyl-2-pyrryl)methylene]-3,5-dimethyl-, di-Et ester, and *H Br*, 2184³.
- 4-Isopyrrolepropionic acid, 5-bromo-2-[(4- β -carboxyethyl)-3,5-dimethyl-2-pyrrylmethylene]-3-methyl-, *H Br*, 1134³.
- 8-Isopyrrolepropionic acid, 2-[(5-bromo-4- β -carboxyethyl)-3-methyl-2-pyrrylmethylene]-4,5-dimethyl-, *H Br*, 1134³.
- C₁₅H₂₀CoN₂ Pyrrole, 2-(methylamino)-, Co deriv., 4698⁹.
- C₁₅H₂₁N 1-Indanamine, 2-(γ -phenylpropyl)-, 2710¹.
- C₁₅H₂₁NO Quinoline, 2-*p*-anisyl-1,2,3,4-tetrahydro-6,8-dimethyl-, and salts, 392⁹.
- Valeramide, β -methyl-*N, N*-diphenyl-, 2697².
- C₁₅H₂₁NO₂ Benzyl alcohol, α -(dimethylaminomethyl)-, α -toluate, 4209⁵.
- Carbamic acid, β, β' -diphenylisopropyl-, Et ester, 4470¹.
- C₁₅H₂₁NO₂S 1-Pentanol, 5-phenylmercapto-, carbanilate, 2423².
- Piperidine, benzylphenylsulfonyl-, 2975⁹.
- C₁₅H₂₁NO₃ (See also *Codeine*.)
- Anisyl alcohol, α -(dimethylaminomethyl)-, benzoate, *H Cl*, 4269⁶.
- Codeinone, dihydro-, P 5474⁴.
- Phenol, 2-ethoxy-5-propyl-, carbanilate, 1890².
- Pseudothebainone, 3710⁶.
- C₁₅H₂₁NO₃ Desoxycodizone, and *H Cl*, 1644².
- Desoxythebaizonic acid, dihydro-, and *H Cl*, 1643².
- C₁₅H₂₁NO₄ Isodihydrothebaizonic acid, and *H Cl*, 1644².
- C₁₅H₂₁NO₄ Benzyl alcohol, α [α -(α -hydroxybenzylamino)ethyl]-, acid oxalate, 4205⁶.
- Thebaizonic acid, hydroxydihydro-, and *H Cl*, 1643², 1644².
- C₁₅H₂₁NO₂ 2-Butanone, 3-benzyl 4-phenyl-, semicarbazone, 3927⁴.
- Camphanoximoxaline, 7(or 8)-acetamide-, 2169⁷.
- C₁₅H₂₁NO₂S Glycine, *N*-[*N*- α -(2-naphthyl-4-isonamido)butyryl]glycyl-, 2993¹.
- C₁₅H₂₁NO₂S Semicarbazone of acid from Hansson acid, 4707⁸.
- C₁₅H₂₂ Bimesityl, 1406⁹.
- C₁₅H₂₂BrNO (α -Benzylphenacyl)trimethylammonium bromide, 2117⁴.
- Dimethylphenacylphenethylammonium bromide, 2117⁴.
- C₁₅H₂₂IN 1,1,3,3-Tetramethyl-2-phenylindolinium iodide, 3927¹.
- Trimethyl-2-phenyl-1-indanylammonium iodide, 4213⁹.
- C₁₅H₂₂INO Diethylphenacylphenylammonium iodide, 2117⁴.
- C₁₅H₂₂N₂ Aniline, bisisopropenyl-, and *H Cl*, 4688⁴.
- Aniline, *p, p'*-cyclohexylidenebis-, and *H Cl*, 4687⁴.
- C₁₅H₂₂N₂O₂ (See also *Halocaine*.)
- 3-Isonitazolecarboxylic acid, 1-benzyl-4,5,6,7-tetrahydro-4,6-dimethyl-, Me ester, 2972⁸.
- Phenetole, 4,4'-azobis[3-methyl-, 1888¹.
- Quinazoline, 6-ethoxy-1,2,3,4-tetrahydro-3-phenetyl-, 3929⁴.
- C₁₅H₂₂N₂O₂ Barbituric acid, 5-allyl-1-benzyl-, sec-butyl-, 821².
- C₁₅H₂₂N₂O₄ Benzoic acid, *p*-(2-hydroxy-3-keto-4,4,5,5-tetramethyl- Δ^1 -cyclopentenyl azo)-, Et ester, 109⁹.
- 4-Isopyrrolepropionic acid, 2-[(4- β -carboxyethyl)-3,5-dimethyl-2-pyrrylmethylene]-3-methyl-, *H Br*, 1134³.
- 3-Isopyrrolepropionic acid, 2-[(4- β -carboxyethyl)-3-methyl-2-pyrrylmethylene]-4,5-dimethyl-, *H Br*, 1134³.
- C₁₅H₂₂N₂O₂S₂ Leucine, *N*-(*N*-2-naphthylsulfonyl)glycyl-, 1389⁹.
- C₁₅H₂₂N₂O₂ Urea, α, α' -2,3-butylenbis[β -phenyl-, 3663¹.

- C₁₈H₂₈N₄O₂ Altromethose, phenylosazone, 2940¹.
- C₁₈H₂₈N₄O₄ Fructose, phenylosazone, 5469¹.
d-Glucose, phenylosazone, 5469².
- C₁₈H₂₈N₄O₂ 2-Butanol, 3-benzylamino-2-methyl-, picrate, 3908⁸.
- C₁₈H₂₈O Benzohydrol, α -amyl-, 5161⁵.
- C₁₈H₂₈O₂ Benzohydrol, 2-isopropyl-4-methoxy-5-methyl-, 1123¹.
m-Cresol, butylidenebis-, 4690¹.
Phenol, *p*, *p'*-2,5-hexylenebis-(*t*), 4688⁷.
p, *p'*-(1,1,3-trimethyltrimethylene)bis-, 4688⁷.
- C₁₈H₂₈O₃ Benzoic acid, diethyl acetal, 4692¹.
Glyoxylic acid, phenyl-, bornyl ester, 3916¹.
- C₁₈H₂₈O₄ γ -Pentenic acid, α -acetyl δ -*p*-cumenyl β -keto-, Et ester, 4211².
- C₁₈H₂₈O₁₀S₂ Resorcinol, 4,6- β -mercapto-, tetraethylcarbonate, 826¹.
- C₁₈H₂₈NO₂ See *Lobeline*.
- C₁₈H₂₈NO₂ Pseudothelbainone, dihydro-, 3710².
Thelbainone, β -dihydro-, 3710².
- C₁₈H₂₈NO₄ 2-Camphanecarbinol, *p*-nitrobenzoate, 2433¹.
- C₁₈H₂₈NO₆ Isothelbainonic acid, tetrahydro-, 1644¹.
Seksanolone, 4223⁸.
- C₁₈H₂₈NO₂ Compd, decomp. 231-5°, from the hydrochloride of hydroxydihydrothelbainonic acid, and -HCl, 1643¹.
- C₁₈H₂₈N₂ Aniline, *p* phenylazo-*N*, *N*-dipropyl-, 4200⁸.
- C₁₈H₂₈HgN₂ Aniline, *p*, *p'* mercuribis[λ -ethyl-*N* methyl-, 1889¹².
- C₁₈H₂₈HgN₂O₄ *o*-Toluidine, λ , λ' mercuribis-, diacetate, 1121⁷.
- C₁₈H₂₈N₂ Aniline, *N*, *N*-dimethyl *p*, *p'*-butylidenebis-, 1689².
Aniline, *p*, *p'*-2,5-hexylenebis-(*t*), and -HCl, 1688².
p, *p'*- α -methylpropylidenebis[*N*-methyl-, 1688².
p, *p'*-(1,1,3-trimethyltrimethylene)bis-(*t*), and -HCl, 4688⁷.
3,3'-Bimesidine, 1406⁸.
- C₁₈H₂₈N₂O₂ Cinchoninamide, 2 ethoxy *N*, *N*-dipropyl-, P 1217⁸.
Hydrobenzoin, *p*, *p'*-bis(dimethylamino)-, 124¹.
Isopyrrole, 2-[3-(β -carboxyethyl)-4,5-dimethyl-2-pyrrolylmethylene]-4-ethyl-3,5-dimethyl-, -HBr, 4226¹.
Isopyrrolepropionic acid, 2-(3,5-dimethyl-2-pyrrolylmethylene)-3,5-dimethyl, Et ester, -HBr, 5191².
- C₁₈H₂₈N₂O₂ Barbituric acid, 1-benzyl δ ethyl δ -isoamyl-, 821².
Chinonic acid, 2-(diethylaminoethoxy), Et ester, P 1995⁸.
ethoxy-, diethylaminoethyl ester, P 1995⁸, P 5013¹.
- C₁₈H₂₈N₂O₄ 4-Homopyrocatechol, α -methylamino-, oxalate, 5162⁸.
- C₁₈H₂₈N₆O₂ Benzene, hexaacetamido-, 2428¹.
Benzenehexamine, hexa-Ac deriv., 823².
- C₁₈H₂₈O₂ Camphor, phenylhydroxy-, Et ether, 1405⁸.
- C₁₈H₂₈O₂ Glyoxylic acid, phenyl-, menthyl ester, 3916¹.
 Δ^1 -5-Nonenone, 6,6-dimethyl-1-(3,4-methylenedioxyphenyl)-, 4942¹.
- C₁₈H₂₈O₄ Malonic acid, (*m*-carboxybenzyl)methyl-, tri-Et ester, 138².
- C₁₈H₂₈BrN₂ Isopyrrole, 2-[(5-bromo-3,4-diethyl-2-pyrrolyl)methylene]-3,4-diethyl-5-methyl-, and -HBr, 2184⁸.
- C₁₈H₂₈BrN₄O₄ Acetanilide, α -[*N*-[*N*-(α -bromo-isocaproyl)glycyl]glycyl]amino-, 2992².
- C₁₈H₂₈Br₂N₂ Isopyrrole, 2-[(5-bromo-3,4-diethyl-2-pyrrolyl)methylene]-3,4-diethyl-5-methyl-, perbromide, 2184⁷.
- C₁₈H₂₈ClO Δ^1 3-Dodecenone, 1-(chlorophenyl)-, 1167⁸.
- C₁₈H₂₈NO₂ Cyclohexanol, 4-cyclopentyl-, carbamate, 4689⁸.
Desoxytetrahydro-momenine, and -HCl, 3709⁹.
- C₁₈H₂₈NO₄ Base, m. 180°, from reduction of sinomenine, 3710².
Desmethoxydihydrosinomenol, 3710¹.
Thebacoline, dihydrohydroxy-, 3710¹.
-, dihydrooxy-, 11, 4705⁸.
Thebanol, dihydro-, 3710¹.
- C₁₈H₂₈NO₃S 3-Camphorsulfonamide, *N* ethyl-, 1887⁷.
- C₁₈H₂₈NO₄ Cellulosamine, 3572⁷.
- C₁₈H₂₈N₂O Quinoline, (dimethylaminocyclohexylamino)methoxy-, P 669⁹.
- C₁₈H₂₈N₂O₂ Piperidine, 1,1'-piperonylidenebis-, 5176¹.
- C₁₈H₂₈N₂O₄ 6,12(5,11)-Phenhomazinedione, 5,11-diacytyldodecahydro-, 2958¹.
- C₁₈H₂₈N₂O₂ Malonamic, α butyl- α -ethyl *N*-phenylethylpharmyl-, 3024¹.
- C₁₈H₂₈N₂O₂ Pyrrolidine, 1-cyclohexyl-2,5-dimethyl-, picrate, 1162².
- C₁₈H₂₈O₂ Compd, b. 260-70°, from cyclohexyldienebisphenol, 4689⁸.
 Δ^1 -3-Dodecenone, 1-saheyl-, 1168⁸.
- C₁₈H₂₈O₈ Δ^1 -1,2,3,4-Cyclohexenetetracarboxylic acid, tetra-Et ester, 3674¹.
- C₁₈H₂₈O₁₂ Sorbitol, hexacetate, 4296².
- C₁₈H₂₈AlO₂ 2,6-Hexanedione, Al deriv., P 606⁷, 2424².
- C₁₈H₂₈CoO₆ 2,4-Hexanedione, Co deriv., 1606⁸.
2,4-Pentanedione, 3-methyl-, Co deriv., P 606⁸.
- C₁₈H₂₈CrO₂ 2,4-Hexanedione, Cr deriv., P 606⁸.
- C₁₈H₂₈FeO₂ 2,4-Hexanedione, Fe deriv., P 606⁷.
2,1-Pentanedione, 3-methyl-, Fe deriv., 1606⁷.
- C₁₈H₂₈MnO₆ 2,4-Hexanedione, Mn deriv., 1606⁸.
- C₁₈H₂₈N Compd, b. 195-205°, from dimethyl aniline and menthone, 4690².
- C₁₈H₂₈NO₂ Benzanilide, *ar*-hexahydro-3'-isomox-, 1131².
- C₁₈H₂₈NO₄ Capric acid, γ -hydroxy-, Me ester carbamate, 1388².
- C₁₈H₂₈NO₈S Chondroitinsulfuric acid, 1922².
- C₁₈H₂₈N₂O₃ Quinoline, 8-[β -(β -diethylaminoethyl)mercaptol]ethylamino]-6-methoxy-, and -HCl, P 241⁸.
- C₁₈H₂₈N₂O Quinoline, 8-[β -(β -diethylaminoethoxy)ethylamino]-6-methoxy-, and -HCl, P 241⁸.
- C₁₈H₂₈N₂O₄ Acetanilide, α [λ -(*N*-leucylglycyl)glycyl]amino-, 2992².
- C₁₈H₂₈Br₂O₂ Stearic acid, octabromo-, 4928⁹.
- C₁₈H₂₈N₂O₂ Cyclopentanecethylamine, *N*, λ 2,2,3-pentamethyl-, picrate, 1405⁷.
- C₁₈H₂₈N₂O₈ 2-Hexanol, 5-cyclohexylamino-, picrate, 4462².
2-Pentanol, 4-cyclohexylamino-3-methyl-, picrate, 4462².
- C₁₈H₂₈O₂ Acid from sardine oil, 4928⁹.
- C₁₈H₂₈O₁ Gingerol, methyl-, 1404⁶.

- C₁₈H₃₂O₄ 1,2,3,4 - Cyclohexanetetracarboxylic acid, tetra-Et ester, 3674^a.
- C₁₈H₃₂O₁₁ Glycolaldehyde, glucoside tetraacetate, di-Me acetal, 3902^a.
- C₁₈H₃₁NO₂ Lauranilide, λ-hydroxy-, 506^a.
- C₁₈H₃₁NO₂ Glucosidyl diethylamide, tetraacetyl-, -HCl, 4450^a.
- C₁₈H₃₁N₃O₂ Kessotriketone, trisemicarbazone, 3455^a.
- C₁₈H₃₁BrN₃O₇ Glutamic acid, N-[N-(α-bromoisovaleryl)leucyl]glycyl-, 374^a.
- C₁₈H₃₁Br₂O₂ Eleostearic acid, θ,ν-dibromo-, 3215^a.
- C₁₈H₃₁Cl₂FeN₄ + 6H₂O, 3638^a.
- C₁₈H₃₁N₃O₇ sulfate—see Butyn.
- C₁₈H₃₁N₃O₇ Tetrapropylammonium picrate, 5361^a.
- C₁₈H₃₁N₃O₈ Hexamethylenetetramine, phenol-sulfonate, 4189^a.
- C₁₈H₃₀O₂ (See also *Linolenic acid*.)
Eleostearic acid, 5160^a.
Gorlic acid, *Ls salt*, 113^a.
- C₁₈H₃₀O₂ Camphorismol, diacetate, 3051^a.
Phthalic acid, Bu cyclohexyl ester, P 1138^a.
- C₁₈H₃₀O₁₁ Isotrihexosan, 4676^a.
- C₁₈H₂₉ClO Chaulmoogryl chloride, 114^a.
- C₁₈H₂₉NO Gorlamide, 113^a.
- C₁₈H₂₉N₂O Chaulmoogryl azide, 114^a.
- C₁₈H₂₇P Phosphine, diisohexylphenyl-, 4442^a.
- C₁₈H₂₇BrN₂O₄ Lysine, N, N₆-bis(α-bromoisocaproyl)-, 1610^a.
- C₁₈H₂₇Br₂O₂ Eleostearic acid, tetrabromide, 1873^a.
Stearic acid, tetrabromo-, 3212^a.
- C₁₈H₂₇IP Diamylmethyl-*p*-tolylphosphonium iodide, 4442^a.
Disoamylmethyl-, *p*-tolylphosphonium iodide, 4442^a.
Methylbis(β-methylbutyl)-*p*-tolylphosphonium iodide, 4442^a.
- C₁₈H₂₇N₂O₇ Glutamic acid, N-[N-(N-valyl-leucyl)glycyl], 374^a.
- C₁₈H₂₅O₂ (See also *Chaulmoogric acid*; *Eleostearic acid*; *Linoleic acid*.)
θ,α-Octadecadienic acid, 4192^a.
Stearolic acid, 2311^a, 4226^a.
- C₁₈H₂₅O₁₁ Anhydrofructose, trimethyl-, dimer, 3907^a.
- C₁₈H₂₅O₁₁ (See also *Raffinose*.)
Galactose, θ-β-cellobionido-, 107^a.
—, 6-β-lactosido-, 107^a.
Gentianose, 5544^a.
Isotrihexose, 4676^a.
Melezitose, 3230^a, 4486^a.
Trifructosan, 912^a.
- C₁₈H₂₅As Arsine, tricyclohexyl-, 120^a.
- C₁₈H₂₅N₃ Base, b.p. 140–5°, from *N*-cyclohexenyl-1,3-cyclohexanediamine, 1131^a.
- C₁₈H₂₅O₁₁P *d*-Glucose, phosphate, 2042^a.
- C₁₈H₂₅Br₂O₂ 1-Nonanol, 9-bromo-, θ-bromo-pelargonate, 3663^a.
Stearic acid, dibromo-, 2312^a.
- C₁₈H₂₅HgO₄ 1-Tetradecene, Hg(OAc)₂ compd., 3899^a.
- C₁₈H₂₅IN Dihydro-α-curcumenyltrimethylammonium iodide, 140^a.
- C₁₈H₂₅N₃O Chaulmoogric acid, hydrazide, and -HCl, 114^a.
- C₁₈H₂₅O₂ (See also *Elaidic acid*; *Isooleic acid*; *Oleic acid*.)
Cyclohexanelauroic acid, P 848^a.
Petroselinic acid, 4968^a.
π-Tridecic acid, α-cyclopentyl-, P 3543^a.
Vaccenic acid, 373^a.
- C₁₈H₂₅O₂ (See also *Ricandaidic acid*; *Ricinoleic acid*.)
Lactarinic acid, 3005^a.
Stearic acid, keto-, 629^a.
- C₁₈H₂₅O₂ Hexadecanedicarboxylic acid, 3130^a.
Juniperic acid, acetate, 3664^a.
- C₁₈H₂₅O₂ Pelargonic acid, θ-hydroxy-, θ-hydroxy-pelargonate, 3663^a.
- C₁₈H₂₅BrO₂ Stearic acid, *p*-bromo-, 3664^a.
- C₁₈H₂₅N₂O₂ Stearyl azide, θ,α-dihydroxy-, 4674^a.
- C₁₈H₂₅Ag₂N₁₀O₈ + 6H₂O, 1587^a.
- C₁₈H₂₅Cl₂N₁₁Sb₂, 2896^a.
- C₁₈H₂₅N₂O₄ Lysine, N, N'-dileucyl-, 1610^a.
- C₁₈H₂₅O 2-Pentadecanone, 6,10,14-trimethyl-, 3702^a.
- C₁₈H₂₅O₂ (See also *Stearic acid*.)
Capric acid, α-octyl-, 2421^a.
Lauric acid, heptyl ester, 4926^a.
—, α-hexyl-, 2421^a.
Margaric acid, α-methyl-, 2421^a.
Myristic acid, Bu ester, 4926^a.
—, α-butyl-, 2421^a.
—, α-sec-butyl-, 2421^a.
Palmitic acid, Et ester, 318^a.
—, α-ethyl-, 2421^a.
Pentadecanoic acid, α-isopropyl-, 2421^a.
—, α-propyl-, 2421^a.
π-Tridecic acid, α-amyl-, 2421^a.
—, α-(α-methylbutyl)-, 2421^a.
Undecylic acid, α-heptyl-, 2421^a.
- C₁₈H₂₅O₂ 1,16-Hexadecanediol, monoacetate, 3664^a.
Margaric acid, γ-hydroxy-, Me ester, 3664^a.
Stearic acid, *p*-hydroxy-, 3664^a.
- C₁₈H₂₅O₄ Stearic acid, dihydroxy-, 3389^a, 5382^a.
- C₁₈H₂₅O₂ See *Satiric acid*.
- C₁₈H₂₅O₈ Stearic acid, dihydroxy-sulfo-, 1140^a.
- C₁₈H₂₅N₂O₂ Stearic acid, θ,α-dihydroxy-, hydrazide, and -HCl, 4674^a.
- C₁₈H₂₅Cl₂N₂O₂Pt Triethyl-α-hydroxyallyl ammonium chloroplatinate, 2150^a.
- C₁₈H₂₅Cl₂Co₂N₂O₄, 2385^a.
- C₁₈H₂₅Cl₂Co₂N₂O₄, 2385^a.
- C₁₈H₂₅Cl₂Co₂N₂O₄, 2385^a.
- C₁₈H₂₅Co₂N₂O₄, 2385^a.
- C₁₈H₂₅Mo₂N₂O₄, 4419^a.
- C₁₈H₂₅Br₂Cl₂O₈ Phenoltetrachlorosulfonephthalin, tetrabromo-, 1404^a.
- C₁₈H₂₅Br₂O₈ Phenoltetrabromosulfonephthalin, tetrabromo-, 1404^a, 3922^a.
- C₁₈H₂₅ClO₂ 7-meso-Benzanthrene-3,4-dicarboxylic anhydride, 10-chloro-7-keto-, P 71^a.
- C₁₈H₂₅Br₂HgO₂S Sulfonefluorescein, tetrabromo-(hydroxymercuri)-, 1896^a.
- C₁₈H₂₅Br₂HgO₂S Sulfonefluorescein, tetrabromo-bis(hydroxymercuri)-, 1896^a.
- C₁₈H₂₅Br₂O₈S Sulfonefluorescein, 4',5',6',7'-tetrabromo-, 1896^a.
- C₁₈H₂₅Br₂O₈S Phenoltetrabromosulfonephthalin, dibromo-, 1404^a.
- C₁₈H₂₅Cl₂HgO₂S Sulfonefluorescein, tetrachloro-(hydroxymercuri)-, 1896^a.
- C₁₈H₂₅Cl₂HgO₂S Sulfonefluorescein, tetrachloro-bis(hydroxymercuri)-, 1896^a.
- C₁₈H₂₅Cl₂O₈S Sulfonefluorescein, 4',5',6',7'-tetrachloro-, 1896^a.
- C₁₈H₂₅Hg₂Cl₂O₈S Sulfonefluorescein, (hydroxymercuri)tetrachloro-, 1896^a.
- C₁₈H₂₅Hg₂Cl₂O₈S Sulfonefluorescein, bis(hydroxymercuri)tetrachloro-, 1896^a.
- C₁₈H₂₅I₂O₈S Sulfonefluorescein, 4',5',6',7'-tetraiodo-, 1896^a.

- $C_{15}H_{14}N_2O_7$ 7,8-Acenaphthoxazole, 3,4-dinitro-8-(*m*-nitrophenyl)-, 2964⁹.
- $C_{15}H_{14}O_8$ 7-*meso*-Benzanthrene-3,4-dicarboxylic anhydride, 7-keto-, P 7151.
- $C_{15}H_{12}Br_2N_2O_5$ 7,8-Acenaphthimidazole, 8-(5-bromosalicyl)-3,4-dinitro-, 2964⁹.
- $C_{15}H_{12}Br_2O_5$ Naphthalic anhydride, bromohydroxy-, benzoate, 2435⁴.
- $C_{15}H_{12}N_2O_7$ 7,8-Acenaphthoxazole, 8-(3,5-dihydroxyphenyl)-3,4-dinitro-, 2964⁹.
- $C_{15}H_{12}Br_2HgO_5S$ Sulfonefluorescein, dibromo-(hydroxymercuri)-, 1896³.
- $C_{15}H_{12}Br_2Hg_2O_5S$ Sulfonefluorescein, dibromolactone-(hydroxymercuri)-, 1896³.
- $C_{15}H_{12}Br_2O_5S$ 3-Isoxanthene-9-*o*-benzenesulfonic acid, dibromo-2,6,7-trihydroxy-3-keto-, 2964⁹.
- $C_{15}H_{10}Br_2O_5S$ Bromophenol blue, 1336¹.
Phenoltetrabromosulfonephthalic acid, 1404⁴.
- $C_{15}H_{10}Cl_2HgO_5S$ Sulfonefluorescein, dichloro-(hydroxymercuri)-, 1896³.
- $C_{15}H_{10}Cl_2O_5S$ Sulfonefluorescein, dichloro-, 1896³.
- $C_{15}H_{10}Cl_4O_5S$ Phenoltetrachlorosulfonephthalic acid, 1404⁴.
- $C_{15}H_{10}Hg_2O_5S$ Sulfonefluorescein, (hydroxymercuri)diiodo-, 1896³.
- $C_{15}H_{10}Hg_2O_5S$ Sulfonefluorescein, bis(hydroxymercuri)diiodo-, 1896³.
- $C_{15}H_{10}N_2O_7$ 7,8-Acenaphthoxazole, 8-*o*-nitrophenyl-, 2964⁹.
- $C_{15}H_{10}N_2O_8$ 7,8-Acenaphthoxazole, 8-(3,5-dihydroxyphenyl)-4-nitro-, 2964⁹.
- $C_{15}H_{10}N_2O_{10}$ Cresol, dimercapto-, dipicrate, 825⁹, 826¹.
- $C_{15}H_{10}O_8$ Benzanthrenedicarboxylic acid, keto-, P 7151.
- $C_{15}H_{10}O_9S$ Sulfoneviolet, 2964⁹.
- $C_{15}H_9ClN_7$ 7,8-Acenaphthimidazole, 8-*p*-chlorophenyl-, 2964⁹.
- $C_{15}H_9Cl_3Hg_3O_5$ Aurin, tris(chloromercuri)-, 4943⁷.
- $C_{15}H_9Cl_2NO$ Benzamide, *N*, *N*-bis-(2,4-dichlorophenyl)-, 2952⁴.
Benzamide, *N*-(chlorophenyl) *N*-(2,4,6-trichlorophenyl)-, 2952⁴.
Benzimidic acid, *N*-(chlorophenyl)-, trichlorophenyl ester, 2952⁴.
-, *N*-(2,4-dichlorophenyl)-, 2,4-dichlorophenyl ester, 2952⁴.
- $C_{15}H_9NO_7$ 7,8-Acenaphthoxazole, 8-(3,5-dihydroxyphenyl)-, 2964⁹.
- $C_{15}H_9N_2O_7$ 7,8-Acenaphthimidazole, 8-(*m*-nitrophenyl)-, 2964⁹.
- $C_{15}H_9N_2O_8$ 7,8-Acenaphthimidazole, 4-nitro-8-salicyl-, 2964⁹.
- $C_{15}H_9HgO_5S$ Sulfonefluorescein, (hydroxymercuri)-, 1896³.
- $C_{15}H_9Hg_2O_5S$ Sulfonefluorescein, bis(hydroxymercuri)-, 1896³.
- $C_{15}H_9N_7$ 7,8-Acenaphthimidazole, 8-phenyl-, 2964⁹.
- $C_{15}H_9N_7O$ 7,8-Acenaphthimidazole, 8-salicyl-, 2964⁹.
14-Diquinolisoimidazolone, 1410⁹.
- $C_{15}H_9N_2O_7$ Phenazine, benzoyl-*a*-hydroxy-, 2717⁹.
- $C_{15}H_9N_2O$ 8-Acenaphthorhizadiazine, phenylhydrazide, 139⁹.
- $C_{15}H_9N_2O_7$ Quinolone, (2,4-dinitro-1-naphthylamino)-, 3229⁹, 4.
- $C_{15}H_{12}N_2O_8$ Phenol, *p*-(2,4-dinitrophenylazo)-, benzoate, 4679⁹.
- $C_{15}H_{12}O_8$ 1,2-Benzanthrene-7,12-dione, 5-methoxy-, 5472².
- $C_{15}H_{12}O_9$ 3-Isoxanthene-9-*o*-trihydroxy-9-phenyl-, 3158¹.
- $C_{15}H_{12}O_8S$ 3-Isoxanthene-9-*o*-benzenesulfonic acid, 2,6,7-trihydroxy 3-keto-, and salt, 2964⁹.
- $C_{15}H_{12}BrO$ Benzophenone, 2(3 and 4)-bromo-4'-phenyl-, 3922⁵.
- $C_{15}H_{12}NO$ 2(3) α -Naphthalone, 3-benzal-, 4916⁴.
- $C_{15}H_{12}NO_4$ Coptisine, 4222¹.
Nicotinic acid, 4 (*ar*, *ar'*, α -trihydroxybenzohydroxy)- γ lactone, 5320⁹.
- $C_{15}H_{12}NO_5S$ Phenol, phenylmercapto-, *p*-nitrobenzoate, 2956⁹.
- $C_{15}H_{12}NO_7$ 9-Fluorenone, *p*-nitrophenylhydrazide, 832¹.
Quinolunide, *N*-(*p*-(*p*-aminophenyl)-phenyl)-, 127¹.
- $C_{15}H_{12}NO_7$ 2-Fluorolamine, *N*-(2,4-dinitrophenyl)-, 1895⁶.
- $C_{15}H_{12}Indene$, 1'-2-naphthyl-, 2707¹.
- $C_{15}H_{12}BrNO$ 2(9b)- α -Naphthalone, 7-bromo-9b-methyl 1-phenyl-, 3699¹.
- $C_{15}H_{12}Br_2NO$ Benzoic acid, β , β -bis(*p*-bromophenyl)-hydrazide, 4938⁹.
- $C_{15}H_{12}NO_7$ Naphthalimide, *N*-(*N*-methylanilino)-, 4214¹.
Naphthalimide, *N*-toluene-, 4214¹.
- $C_{15}H_{12}NO_7$ 2-Indolecarboxylic acid, 3 (β -phthalimidoethyl)-, 831⁴.
- $C_{15}H_{12}NO_8$ Phthalimide, *N*, *N'*-[(hydroxymethyl)ethylene]bis-(2), 2152¹.
Phthalimide, *N*, *N'*-[(2-hydroxytrimethylene)bis-(2)], 2152¹.
- $C_{15}H_{12}NO_9$ Spiroacridine-5(10),1'(3')-furo[3,4- γ]pyridin] 3'-one-, 2,8-diamino-, 5320⁹.
- $C_{15}H_{12}NO_9$ Benzoic acid, β , β -bis(*p*-nitrophenyl)-hydrazide, 4938⁹.
- $C_{15}H_{12}NO_5S$ *p*-Toluenesulfonamide, 2',4'-dinitro 6'-(*p*-nitrophenyl)-, 830⁹.
- $C_{15}H_{12}NO_8$ Benzoic acid, *o*-(4-keto-2'-cyclohexadienylidenehydrazino)-, 2,4-dinitrophenylhydrazide, 4679⁹.
- $C_{15}H_{12}O_8$ *p*-Toluquinone, bis-(2,4-dinitrophenylhydrazide), 4679⁹.
- $C_{15}H_{12}O_9$ 1,2-Benzanthrene, 5-methoxy-, 5472².
1-Benzanthrene, 3-phenyl-, P 1416².
Fuchsonic, 3157¹.
1- α -Naphthandione, 3-phenyl-, 2707¹.
- $C_{15}H_{12}OS$ 7-*meso*-Benzanthrene, (ethylmercapto)-, P 4710⁹.
- $C_{15}H_{12}O_9$ (See also *Benzamin*)
Acrylic acid, β -(2-naphthyl) β -phenyl-, 2707¹.
1,2-Benzanthrene-7(12)-one, 5-methoxy-, 5472².
- $C_{15}H_{12}O_9$ See *Acridin*.
- $C_{15}H_{12}O_8S$ 9-Fluorenone, 9-phenyl-, acid salt, *Mg* salt, 5180⁹.
- $C_{15}H_{12}O_9$ 3-Pentadecanone, 1,5-bis(3,4-methylene-dioxyphenyl)-, 2170¹.
- $C_{15}H_{12}O_8S$ Phenol red, 2871¹.
- $C_{15}H_{12}O_8$ Alizarin, 6-methyl-, diacetate, 2174⁹.
Anthrarufin, 2-methyl-, diacetate, 2174⁹.
Malonic anhydride, α -phenacylpiperonyl-, 3210⁹.
Quinone, 2-hydroxy-3,6-bis(β -hydroxyphenyl)-5-methoxy-, 1197⁹.

- C₁₀H₁₄O₇** Alizarin, 1-acetate, 2-ethylcarbonate, 4697².
 Hystazarin, 1-methoxy-, diacetate, 4697².
C₁₀H₁₄O₈ Hydroquinonesulfonephthalin, hydroxy-, 2964⁴.
C₁₀H₁₄O₉ *o*-Toluenesulfonic acid, α -(2,3-dihydroxy-4-keto-*p*-phenylidene)- α -(2,3,4-trihydroxyphenyl)-, 3458¹.
C₁₀H₁₁BrN₂O Benzoic acid, β -(*p*-bromophenyl)- β -phenylhydrazide, 4938².
C₁₀H₁₁Br₂N₂S 5-Bromo-1-[γ -[5-bromo-2-methyl-1(2)-benzothiazylidene]propenyl]-2-methylbenzothiazolium iodide, 391¹.
C₁₀H₁₁Br₂N₂ Benzanilide, 2',4-dibromophenylhydrazone, 3680¹.
C₁₀H₁₁Br₂NO 2(3)- α -Naphthazalone, 3,3a,4,5-tetrabromo-3a,4,5,9b-tetrahydro-9b-methyl-1-phenyl-, 3699².
C₁₀H₁₁ClN₂O₂ Carbazole, 9-benzoyl-6-chloro-1,2,3,4-tetrahydronitro-, 139².
C₁₀H₁₁Cl₂N₂S₂ Chloro-1-[γ -[chloro-2-methyl-1(2)-benzothiazylidene]propenyl]-2-methylbenzothiazolium iodide, 390², 391¹.
C₁₀H₁₁Cl₂OP Phosphine, dichloro(triphenylmethoxy)-(?), 3921².
 Phosphine oxide, dichloro(triphenylmethyl)-(?), 3921².
C₁₀H₁₁IN₂O [3,2'-Biquinoline]-2-ol, methiodide, 1900³.
C₁₀H₁₁N Aniline, *N*-diphenylmethylene-, 3909¹.
C₁₀H₁₁N 2-Acetonaphthone, 1-(phenylimino-methyl)-, 1899².
p-Benzene, 4-[(*p*-aminophenyl)phenylmethylene]-, 384¹.
p-Cresol, α -(*p*-imino-*p*-phenylidene)- α -phenyl-, 384¹.
 2(9b)- α -Naphthazalone, 9b-methyl-1-phenyl-, 3690¹.
 1- α -Naphthindanone, 3-phenyl-, oxime, 2707¹.
C₁₀H₁₁NO₂ See *Alotquinol*.
C₁₀H₁₁NO₂ Cinnamic acid, β -benzoyl- α -cyano-, Et ester, 2946².
C₁₀H₁₁NO₂ Compds from oxidation of 3a,9b-dihydro-3a-hydroxy-9b-methyl-1-phenyl-2(3)- α -naphthazalone, 3699¹.
C₁₀H₁₁N₂O₂ Benzoic acid, β -(*p*-nitrophenyl)- β -phenylhydrazide, 4938².
 Nicotinic acid, 2-[*p*-(*p*-aminophenyl)phenylcarbamyl]-, 127².
C₁₀H₁₁N₂O₄ Quinoline, 2-(2,4-dinitrostyryl)-4,6-dimethyl-, 4683¹.
C₁₀H₁₁N₂O₅ *p*-Toluenesulfonanilide, dimetaphenyl-, 830¹.
C₁₀H₁₁N₂O₅ Tetryl, compd. with acenaphthene, 2214².
C₁₀H₁₁N₂O₆ Quinone, 2,4-dinitrophenylhydrazone, 4-phenylsemicarbazone, 4679².
C₁₀H₁₁N₂O₆ *p*-Toluquinone, 2,4-dinitrophenylhydrazone, 2-nitrophenylhydrazone, 4679².
C₁₀H₁₁ (See also *Methane, triphenyl*.)
 Biphenyl, *p*-benzyl-, 4936¹.
 Indan, 1-(2-naphthyl)-, 2707¹.
 α -Naphthindan, 3-phenyl-, 2707¹.
C₁₀H₁₁Br₂N₂O Thyroxine, α -bromopropionyl-, Me ester, 1632¹.
C₁₀H₁₁Br₂NO Acetanilide, *N*-(6-bromo-1,2-dihydro-2-keto-1-methyl-1-naphthyl)-, 3699².
 2(3)- α -Naphthazalone, 7-bromo-3a,9b-dihydro-3a-hydroxy-9b-methyl-1-phenyl-, 3699².
C₁₀H₁₁BrNO₂S *p*-Toluenesulfonanilide, 2'-bromo-4'-phenyl-, 830¹.
C₁₀H₁₁ClNO Carbazole, 9-benzoyl-6-chloro-1,2,3,4-tetrahydro-, 139².
C₁₀H₁₁ClNO Quinaldine, 4-chloro- α -veratral-, 4704¹.
C₁₀H₁₁ClN₂O Carbostyryl, 1,3-diacyetyl-, 3-*o*-chlorophenylhydrazone, 1900³.
C₁₀H₁₁N Pseudonitrole, 2-methyl-3-(2-methyl-3-indylmethylene)-, *SmCl₂ compd.*, 3225².
C₁₀H₁₁N₂O Quinoline, 1,2,3,4-tetrahydro-1-(2-quinolylicarbonyl)-, and *HCl*, 1411⁴.
C₁₀H₁₁N₂O₂ Acetophenone, *p*-(2-methoxy-1-naphthylazo)-, 3461².
C₁₀H₁₁N₂O₂ Carbamic acid, 2-phenylcincinonyl-, Et ester, P 4778¹.
C₁₀H₁₁N₂O₅ Acetophenone, 2'-(*p*-nitrophenyl)-, 830¹.
p-Toluenesulfonanilide, 4'-nitro-2'-phenyl-, 830¹.
C₁₀H₁₁N₂O₆ Methysticene, 2,4-dinitrophenylhydrazone, 2965².
C₁₀H₁₁N₂O₇ Benzylamine, *o*-phenyl-, picrate, 2710².
C₁₀H₁₁N₂O Isoquinoline, 6,7-methylenedioxy-1-propyl-, picrate, 2444².
C₁₀H₁₁O Carbinol, triphenyl-, 2637¹, 3157², 3921², 4465².
p-Cresol, α , α -diphenyl-, 3157².
 $\Delta^1,4$ -1-Heptatrienone, 1,7-diphenyl-, 3688².
C₁₀H₁₁O₂ Carbinol, (*p*-hydroxyphenyl)diphenyl-, 3457².
 $\Delta^1,4$ -3,5-Heptadienedione, 1,7-diphenyl-, 4210².
 Propionic acid, β -(2-naphthyl)- β -phenyl-, 2707¹.
C₁₀H₁₁O₂ *o*-Toluic acid, α -(4-methoxy-1-naphthyl)-, 5472¹.
C₁₀H₁₁O₃ Carbinol, triphenyl-, acid sulfate, *Mg salts*, 5180².
C₁₀H₁₁O₄ (See also *Aurin*.)
 $\Delta^1,4$ -3,5-Heptadienedione, 1,7-bis(*m*-hydroxyphenyl)-, 4211².
C₁₀H₁₁O₄ 1,4-Phenanthrenediol, 3-methoxydiacetate, 1899².
C₁₀H₁₁O₅ Flavanone, 5,7-dihydroxy-, diacetate, 836².
 $\Delta^1,4$ -3,5-Heptadienedione, 1,7-bis(2,5-dihydroxyphenyl)-, 4211².
C₁₀H₁₁O₇ 1,4-Benzopyran-2-carboxylic acid, 3-*p*-anisyl-5,7-dimethoxy-, 2180².
 Malonic acid, (α -phenacylpiperonyl)-, 3210².
 Phthalide, 2-(2,5-dihydroxy-*p*-anisyl)-diacetate, 4682².
C₁₀H₁₁O₁₁ Thamnolic acid, 4477².
C₁₀H₁₁Br₂O 3,9,10-Trimethoxy-7-benzos[β indeno[1,2- δ]pyrityl bromide, 150².
C₁₀H₁₁Br₂O₂ 2(1)-Benzofuranone, 4-bromo-1-(2,4-dimethoxybenzal)-3,5-dimethoxy-, 5183².
 9-Phenanthrenecarboxylic acid, 8-bromo-3,4,5,6-tetramethoxy-, 3710¹.
C₁₀H₁₁ClN₂O₄ 8a(4b)-Carbazolol, 9-benzoyl-3-chloro-5,6,7,8-tetrahydro-4b-nitro-, 139².
C₁₀H₁₁ClN₂O₅ *m*-Benzenedisulfonanilide, 4-chloro-5-methyl-, 1630².
C₁₀H₁₁IN₂S₂ 2-Methyl-1-[γ -[2-methyl-1(2)-benzoselenazylidene]propenyl]benzoselenazolum iodide, 1429².

- $C_{11}H_{17}NO$ Acetophenone, p - (ϵ -phenyl - $\Delta^{2,1}$ - pentadienyldeneamino) -, 3688¹.
 α, γ, ϵ - Heptatrienylanilide, δ - phenyl -, 3689¹.
 2(3) - α - Naphthazalone, 5,9b - dihydro 9b - methyl - 1 - phenyl -, 3690².
- $C_{11}H_{17}NO_2$ (See also *Neocinchophen*.)
 Acetanilide, N - (1,2 - dihydro - 2 - keto - 1 - methyl - 1 - naphthyl) -, 3690¹.
 2(3) - α - Naphthazalone, 3a,9b - dihydro - 3a - hydroxy - 9b - methyl - 1 - phenyl -, 3690¹.
- $C_{11}H_{17}NO_2S$ p - Toluenesulfonamide, N , γ - diphenyl -, 4460⁵.
 p - Toluenesulfonanilide, 2' - phenyl -, 8304⁴.
- $C_{11}H_{17}NO_2$ Carbinol, (p - aminophenyl)bis- (p -hydroxyphenyl) -, 384².
 Cinchophen, 4' - methoxy - 6,8 - dimethyl -, 2215⁹.
 Compd., m 150°, from Et β -benzoyl- α -cyanohydrocinnamate, 2946⁴.
 8 - Dibenzoquinolinizone, 5,6 - dihydro - 3,10 dimethoxy -, 2184¹.
 Hydrocinnamic acid, β - benzoyl - α - cyano -, Et ester, 2946⁴.
 Quinaldine, α - (3 - hydroxyvanisal) - 4 - methoxy -, 4703⁹.
 - , 4 - methoxy - α - vanillal -, 4703⁹.
- $C_{11}H_{17}NO_2$ Malonanilic acid, α - (α - phenacyl piperonyl) -, 3210⁶.
- $C_{11}H_{17}N_2$ See *Parafuchsin*.
- $C_{11}H_{17}N_2O$ Acetophenone, 4 - (1 - naphthyl) semicarbazone, 600⁹.
- $C_{11}H_{17}N_2O_2$ Acetophenone, p - (2 - methoxy - 1-naphthylazo) -, oxime, 3461.
 Pyrazolo[5,4 - γ]quinoline - 1,4(2,5) - dione, 5 - ethyl - 3 - methyl - 2 - phenyl -, 2443⁹.
- $C_{11}H_{17}N_2O_2S$ m - Benzenedisulfonanilide, 4 - hydroxy - 6 - methyl - 5 - nitro -, 1630⁷.
- $C_{11}H_{17}N_2O_2$ Acetophenone, p - (2 - hydroxy - 1 - naphthylazo) -, semicarbazone, 3461.
- $C_{11}H_{17}O_2P$ Methanephosphonic acid, triphenyl -, 3921².
- $C_{11}H_{17}BrINO_2$ Alanine, β - [4 - (p - hydroxyphenoxyl) - 3,5 - diiodophenyl] -, Me ester, α - bromopropionyl deriv -, 1632¹.
- $C_{11}H_{17}BrNO_2$ Cinnamic acid, α - (2 - bromo - 4,5 - dimethoxyphenyl) - 3,4 - dimethoxy - 2 - nitro -, 3710¹.
- $C_{11}H_{17}Br_2O_2$ Propiophenone, α, β - dibromo - 2 - hydroxy - 4,6 - dimethyl - β - phenyl -, acetate, 1122².
- $C_{11}H_{17}Br_2N_2O_2S$ 5 - Benzothiazolecarboxylic acid, 1 - p - carboxyanilino -, di-Et ester, tetrabromide, -II Br, 2973⁷.
- $C_{11}H_{17}ClN_2O_2$ Ketone, 3,4 - dihydro - 2,4 - dihydroxy - 3 - quinolyl methyl, α - chlorophenylhydrazones, acetate, 1900³.
- $C_{11}H_{17}I_2O_4$ 6,6a - Dihydro - 6a - iodo - 3,9,10 - trimethoxy - 7 - benzo [β]indeno[1,2 - δ] - pyrylium iodide, 150¹.
- $C_{11}H_{17}N_2O$ (See also *Doebner's violet*.)
 14 - Diquinolisimidazolone, 5,6,6a,12,13,13a - hexahydro -, 1410⁶.
 Quinaldine, aminobenzoalethoxy -, P 613⁵, P 851⁴, P 1218¹.
- $C_{11}H_{17}N_2O_2$ Carbinol, bis(p - aminophenyl) - (p - hydroxyphenyl) -, 384².
 Cinchoninamide, N - benzyl - 2 - ethoxy -, P 1217⁴.
- $C_{11}H_{17}N_2O_2$ Malonanilic acid, α - benzyl - α - cyano -, Et ester, 4193⁶.
- $C_{11}H_{17}N_2O_4$ Benzil, methyl-, dioxime, diacetate, 2709¹.
 Δ - Hydantoinacetic acid, α, δ - dibenzyl -, 2165^{3,7}.
- $C_{11}H_{17}N_2O_5S$ 5 - Benzothiazolecarboxylic acid, 1 - p - carboxyanilino -, di-Et ester, 2973⁷.
- $C_{11}H_{17}N_2O_5$ Oxalic acid, 5 - anilino - 1 - phenyl-imino - $\Delta^{2,1}$ - 2 - pentadienol salt, 2438⁷.
- $C_{11}H_{17}N_2O_5S$ Anthraquinonesulfonic acid, amino (cyclopentylamino) -, P 287⁹.
- $C_{11}H_{17}N_2O_5S_2$ Benzenedisulfonanilide, hydroxy-methyl-, 1630^{7,8}.
- $C_{11}H_{17}N_4O_6$ Methysticon, dihydro-, 2,4-dinitrophenylhydrazones, 2965⁷.
- $C_{11}H_{17}N_4O_6$ Isoquinoline, 3,4 - dihydro - 6,7 methylenedioxy - 1 - propyl -, picrate, 2444².
 Isoquinoline 1 - ethyl - 6,7 - dimethoxy -, picrate, 2444¹.
- $C_{11}H_{17}O_2$ Methane, 1 - naphthoxyphenethoxy -, 1871⁹.
- $C_{11}H_{17}O_2S$ Anthraquinone, 1,4 - bis(ethylmercapto) - 2 - methyl -, 2712⁷.
- $C_{11}H_{17}O_2$ Chalcone, 2' - hydroxy - 4',6' - dimethyl -, acetate, 1122².
 Pentadienone, 1,5 - di - p - anisyl -, 2170⁴, 3911², 4200¹.
 Phenanthrene, 3,5,6 - trimethoxy - 1 - vinyl -, 2978⁹.
- $C_{11}H_{17}O_2\beta$ Butenic acid, α - (α - hydroxybenzyl) - γ - phenyl -, acetate, 1395¹.
 Me ester, formate, 1395¹.
- $C_{11}H_{17}O_2$ Homopterocarbin, acetyl -, 2246¹.
 3 - Pentadienone, 1,5 - bis(4 - hydroxy m -anisyl) -, 3686².
 Rotenone, 3531⁹.
- $C_{11}H_{17}O_2$ Brazilone, trimethyl-, 150².
 Coumarin, 3 - (3,4 - dimethoxyphenyl) - 5,7-dimethoxy-, 4681⁹.
 Isophyllodulin, acetate • mono-Me ether, • 2714⁸.
 9 - Phenanthrenecarboxylic acid, tetra-methoxy-, 3710¹.
- $C_{11}H_{17}O_2$ Acetin, β -mono-, disalicylate, 4685⁹.
 Peristatin, 2501⁸.
- $C_{11}H_{17}ClO_2$ *Hydrochloride*, m. 161-2°, 4681⁹.
- $C_{11}H_{17}N$ Quinoline, 4,6 - diethyl - 2 - phenyl -, • 2443¹.
 Quinoline, 4 - ethyl - 6,8 - dimethyl - 2 - phenyl -, 2443¹.
 Xenylamine, N - benzal - 2',3',4',5' - tetrahydro-, 4687⁸.
- $C_{11}H_{17}NO$ Benzanilide, p - Δ^1 - cyclohexenyl - 4687⁸.
 2(3) - α - Naphthazalone, 3a,4,5,9b - tetrahydro - 9b - methyl - 1 - phenyl -, • 3690².
 Quinoline, ethoxy - 4 - ethyl - 2 - phenyl -, 2443¹.
 p - Toluidine, N - (ϵ - p - anisyl - $\Delta^{2,1}$ - pentadienyldene) -, 3912¹.
 $C_{11}H_{17}NO_2$ p - Anisidine, N - (ϵ - p - anisyl - $\Delta^{2,1}$ - pentadienyldene) -, 3912¹.
 2(3) - α - Naphthazalone, 3a,4,5,9b - tetrahydro - 3a - hydroxy - 9b - methyl - 1 - phenyl -, 3690¹.
 5(4) - Oxazolone, 4 - (4 - isopropenyl - Δ^1 - cyclohexenylmethylene) - 2 - phenyl -, 2248¹, 4942⁷.
 α, γ - Pentadieno - p - toluidine, δ - p - anisyl -, 3912¹.
- $C_{11}H_{17}NO_2$ Benzoic acid, p - (p - methoxycinnamylamino) -, Et ester, 3911⁸.
 Galipolin, 4703⁹.

- α, γ - Pentadien - *p* - aniside, δ - *p* - anisyl -, 3912².
 Quinoline, 2 - (hydroxymethoxyphenethyl) - 4-methoxy-, 4703³, 4704¹.
 Trilobine, 392², 5272².
 C₁₉H₁₉NO₅ 1 - Isobenzofurancarboxamide, 1, 2-dihydro - 2 - keto - 4 - methoxy - *N* - (*m* - methoxyphenethyl) -, 2183³.
 C₁₉H₁₉NO₅ Ethanol, 1 - (3, 4 - diacetoxyphenyl) - 2 - (benzylideneoximino) -, 5162⁴.
 C₁₉H₁₉NO₅ Cinnamic acid, α - (3, 4 - dimethoxyphenyl) - 3, 4 - dimethoxy - 2 - nitro -, 3710².
 C₁₉H₁₉NO₅ Meconin, 2 - asaryl - 3 - nitro -, 4682².
 C₁₉H₁₉N₃O (See also *Parafuchsins*.)
 8 - Pyrrolopyridine, 1, 3 - diacetyl - 2 - methyl -, phenylhydrazone, 4218¹.
 C₁₉H₁₉N₃O₈ Thiazole, 4 - *p* - tolyl - 2 - (β - tolylhydrazino) -, acetyl deriv., 1410¹.
 Δ^4 - Thiazoline, 2 - (acetylmino) - 3 - *p* - toluino - 4 - *p* - tolyl -, 1410².
 C₁₉H₁₉N₃O₅ Des - *N* - tetrandrineketodicarboxylic acid, semicarbazone, 4475².
 C₁₉H₁₉N₃O₅ 1, 2, 4 - Triazole, 3 (and 5) - (β - allylthiocarbamido) - 5 (and 3) - (benzylmercapto) - 1 - phenyl -, 2178².
 C₁₉H₁₉N₃O₅ Glycocyanidide, 5 - (β - benzamidopropyl) -, picrate, 1621².
 C₁₉H₁₉BrNO₅ Thebaizone, bromide, 1642².
 C₁₉H₁₉BrNO₅ Cinnamic acid, 2 - amino - α - (2 - bromo - 4, 5 - dimethoxyphenyl) - 3, 4 - dimethoxy -, 3710².
 C₁₉H₁₉BrN₃O₅ Propionamide, α - bromo - *N* - *N* - bis(phenylcarbamylmethyl) -, 1112².
 C₁₉H₁₉ClIN₃O₅ 4(2) - Chloro - 1 - (*p* - dimethylaminostyryl) - 5 - methoxy - 2 - methylbenzothiazolium iodide, 390².
 C₁₉H₁₉ClIN₃O₅ 5 - Chloro - 1 - (*p* - dimethylaminostyryl) - 2, 3 - dimethylbenzothiazolium iodide, 390².
 C₁₉H₁₉ClINO₅ Dinicotinic acid, 4 - (chlorophenyl) - 2, 6 - dimethyl -, di-Et ester, 3472¹.
 C₁₉H₁₉INO₅ Hydrohydrastinine, phenacyl iodide, 2117¹.
 C₁₉H₁₉N₃ Isopyrazole, 4, 4 - diethyl - 3, 5 - diphenyl -, 4701¹.
 Pyrazole, 1, 4 - diethyl - 3, 5 - diphenyl -, 4701².
 C₁₉H₁₉N₃O₅ Acetic acid, 5 \circ anilino - 1 - phenylimino - Δ^3 4 - 2 - pentadienol salt, 2436².
 Homoterephthal - 1 - amic acid, α - (*p* - dimethylaminobenzal) -, Me ester, 2176².
 C₁₉H₁₉N₃O₅ Benzoic acid, 1 - (*p* - dimethylaminostyryl) - 5 - nitro -, Et ester, 2166².
 Ornithuric acid, 423².
 C₁₉H₁₉N₃O₅ Alanine, *N* - *N*' - carbonylbis(β - phenyl) -, 1618².
 Phenethylamine, *N* - (3, 4 - dimethoxy - 2 - nitrophenylethynyl) - *p* - methoxy -, 4705².
 Tyrosine, *N* - hippuryl -, Me ester, 603².
 C₁₉H₁₉N₃O₅ Carbamylide, *p* - Δ^3 - cyclohexenylthio -, 4687².
 C₁₉H₁₉N₃O₅ Methysticone, tetrahydro 2, 4 - dinitrophenylhydrazone, 2965².
 C₁₉H₁₉N₃O₅ Indoline, 3 - isobutylidene - 2 - methyl - (?) -, picrate, 1636².
 C₁₉H₁₉N₃O₅ Isoquinoline, 1 - ethyl - 3, 4 - dihydro - 6, 7 - dimethoxy -, picrate, 2444¹.
 C₁₉H₁₉N₃O₅ Urea, α - (4 - methyl - 3 - *p* - toluino - 2(3) - thiazylidene)thio - β - *p* - tolyl -, 1410².
 C₁₉H₁₉N₃O₅ 1, 2, 3, 4 - Tetrazol - 5(4) - one, 1, 1' - methylenebis[5 - thio - 1 - xylol] -, 4470².
 C₁₉H₁₉O₅ Cinnamic acid, carvacryl ester, 2432².
 C₁₉H₁₉O₅ Cinnamic acid, α - benzyl - *p* - methoxy-, Et ester, 2959².
 Cinnamic acid, α - (*p* - methoxybenzyl) -, Et ester, 2959².
 C₁₉H₁₉O₅ Glutaric acid, α, β - diphenyl di-Me ester, 4930².
 Hydracrylic acid, α - phenethyl - β - phenyl -, acetate, 1396².
 Malonic acid, benzyl - γ - phenylpropyl -, 2710¹.
 Myristinol, benzoate, 1124¹.
 Spirobi(dioxane), diphenyl, 2619².
 C₁₉H₁₉O₅ 1, 4 - Benzopyran, 3 - (3, 4 - dimethoxyphenyl) - 5, 7 - dimethoxy -, 4681².
 Compd. from trimethylbrazilone, 150².
 Homopterocarpin, acetyldihydro -, 2216².
 C₁₉H₁₉O₅ Chalcone, 2 - hydroxy - 2', 4, 4', 6, 6' - tetramethoxy-, 5183².
 Compd., m. 151 2², from trimethylbrazilone, 150².
 C₁₉H₁₉O₅ Barbatie acid, 1894².
 Meconin, 2 asaryl -, 4682².
 C₁₉H₁₉O₅ Cyclohexanecarboxylic acid, 1, 5 - dihydroxy 1, 2 - isopropylidenedioxy -, γ - lactone, *p* - acetoxybenzoate, 1622².
 C₁₉H₁₉O₅ γ - Pentenic acid, α - acetyl - (2, 5 - dihydroxyphenyl) - β - keto - Et ester, bis-methylcarbonate, 4211².
 C₁₉H₁₉BrN₃O₅ 1 - (*p* - Dimethylaminostyryl) - 5 - methoxy - 2 - methylbenzothiazolium bromide, 390².
 C₁₉H₁₉ClIN₃O₅ Isoquinoline, 3, 4 - dihydro - 1 - (2 - nitroveratryl) -, methochloride, 2981².
 C₁₉H₁₉IN₃O₅ Isoquinoline, 3, 4 - dihydro - 1 - (2 - nitroveratryl) -, methiodide, 2981².
 C₁₉H₁₉NO₅ $\alpha, \gamma, \epsilon, \epsilon, \epsilon$ - Heidecapentenaldehyde, α - (*p* - dimethylaminophenyl) -, 381².
 Piperidine, 1 - benzyl - 2 - benzyl -, 2675².
 C₁₉H₁₉NO₅ Apomorphine, dimethyl ether, 2980 2981¹, 5186¹.
 Benzyl alcohol, α - ethyl - *p* - propenyl - carbamate, 3908².
p - Cinnamotoluide, *p* - propoxy -, 1396².
 Dibenzquinolinine, 5, 6, 13, 13a - tetrahydro - 3, 10 - dimethoxy -, 2184².
 C₁₉H₁₉NO₅ (See also *Epistephanine*, *Epistephanine*, *Thebaine*.)
 Behecrine, methyl ether, 147².
p-Cinnamaniside, *p* - propoxy -, 1396².
 Hydrocotarnine, tolyl -, 1368².
 Insularine, 527².
 Isothebaine, 4704².
 Pseudoepistephanine, 2979¹.
 C₁₉H₁₉NO₅ (See also *Laurotannine*.)
 Desoxythebaizone, 1643².
 C₁₉H₁₉NO₅ Δ^3 - 1 - Propenol, 3 - [3 - methoxy - 4 - (methoxymethoxyphenyl) -, carbanilate, 2963².
 Thebaizone, and salts, 1642², 1613².
 Thebaizonic acid, des - *N* - methyl -, and - HCl, 1643².
 C₁₉H₁₉NO₅ Cinnamic acid, 2 - amino - α - (3, 4 - dimethoxyphenyl) - 3, 4 - dimethoxy -, 3710².
 Me ester, decomp. 220 \circ , of acid from β - thebaizone, 1644¹.
 C₁₉H₁₉NO₅ Protonotrichyl alcohol, " 2

- furylmethylaminomethyl) , 4 - acetate, oxalate, 5162⁴.
- C₁₁H₁₁N₁O₁ 1 - Indanone, 2 - (γ - phenylpropyl) , semicarbazone, 27101.
- C₁₁H₁₁N₁O₁ Phenethylamine, 3 - amino - N (3,4 - dimethoxy - 2 - nitrophenylethynyl) - 4 - methoxy-, 4705⁴.
- C₁₁H₁₁ Methane, cyclohexyldiphenyl-, 4936⁴.
- 1 - Pentene, 2 - phenethyl - 5 - phenyl , 29351.
- C₁₁H₁₁AsN₁O₁ Arsinic, cyclohexylmethylphenyl , hydroxypicrate, 120⁴.
- C₁₁H₁₁BrN₁O₁ Sinomenine, bromo-, 3709⁴.
- C₁₁H₁₁BrN₁O₁ 3 - Isopyrrolepropionic acid, 5 - bromo - 2 - [(5 - bromo - 3 - (β - carboxyethyl) - 4 - ethyl - 2 - pyrrol)methyl]ene) - 4 - ethyl -, -HBr, 1133⁴.
- 4 - Isopyrrolepropionic acid, 5 - (bromo methyl) - 2 - [(5 - (bromomethyl) - 4 - (β - carboxyethyl) - 3 - methyl - 2 - pyrrol)methylene] - 3 - methyl -, -HBr, 1134⁴.
- C₁₁H₁₁ClN₁O₁ Dinicotinic acid, 4 - (chloro phenyl) - 1,4 - dihydro - 2,6 - dimethyl , di-Et ester, 34721.
- C₁₁H₁₁N₁ Cinnamaldehyde, carvacrylhydrazone, 5470⁴.
- C₁₁H₁₁N₁O₁ See *Cinchonidine*.
- C₁₁H₁₁N₁O₁ 1,5 - Pentanediol, dicarbamate, 817⁴, 24231.
- C₁₁H₁₁N₁O₁ Hansen's acid, 1387⁴.
- Homoveratramide, N - (p - methoxy phenethyl) - 2 - nitro -, 4705⁴.
- C₁₁H₁₁N₁O₁ Acid, from Hansen's acid, 1387⁴.
- Dimethyl ester of acid from Hansen's acid, 4707⁴.
- C₁₁H₁₁N₁O₁ Acid from Hansen's acid, and salts, 1387⁴.
- C₁₁H₁₁N₁O₁ Piperidine, 2 - benzyl - 1 - methyl , picrate, 29761.
- C₁₁H₁₁N₁O₁ Carnep'ne, picrate, 42221.
- C₁₁H₁₁O₁ Anisole, cyclopentylidenebis-, 4649⁴.
- Compd., m. 135 7°, from phenol and 2 - methylcyclohexanone, 4649⁴.
- Enanthic acid, diphenyl-, 5181⁴.
- Isocaproic acid, methylidiphenyl-, 5181⁴.
- Phenol, methylcyclohexylidenebis-, 1729⁴, P 2540⁴, 4690⁴.
- Valeric acid, α - phenethyl - δ - phenyl -, 2934⁴.
- C₁₁H₁₁O₁ α - Crocetin, 32271.
- C₁₁H₁₁O₁ Acetophenone, 2,6 - dihydroxy - 3,4 - dimethoxy - α - (3,4,5 - trimethoxyphenyl)-, 2180⁴.
- C₁₁H₁₁Br 3,6 - Nonadiene, 5 - bromo - 2,2,8,8 - tetramethyl - 5 - phenyl , 18931.
- Pentane, 1 - bromo - 2 - phenethyl - 5 - phenyl-, 2934⁴.
- C₁₁H₁₁BrO₁S Glucosyl 1 - bromide, 3 - p - toluenesulfonyl - 2,5,6 - triacetyl, 103⁴.
- C₁₁H₁₁NO₁ Benzoic acid, phenyl, β diethyl aminomethyl ester, and -HCl, 24331.
- C₁₁H₁₁NO₁ Dauricine, 5272⁴.
- Morphine, ethyl-, 1132⁴.
- Tetrandrine, 4475⁴, 5272⁴.
- C₁₁H₁₁NO₁ (See also *Sinomenine*.)
- Dehydrosinomenine, and nitrate, 3710⁴.
- Deoxythebaizonic acid, des - N - methyl dihydro-, 16431.
- Homolycorine, and salts, 4223⁴.
- C₁₁H₁₁NO₁ Dinicotinic acid, 1,4 - dihydro - 4 - (hydroxyphenyl) - 2,6 - dimethyl -, di Et ester, 34721.
- Isodihydrothebazone, 16441.
- Thebazone, dihydro-, 16431.
- C₁₁H₁₁N₁O₁ Acetophenone, 4 - carvacrylsemicarbazone, 5470⁴.
- C₁₁H₁₁N₁O₁S Glycine, N - [N - (N - 2 - naphthylsulfonyl)ethyl]valyl-, 16191.
- Glycine, N - [N - (N - 2 - naphthylsulfonyl)valyl]valyl-, 16191.
- C₁₁H₁₁BrN₁O₁ Compd., m. 203-6°, from 2 - (4 - carboxy - 3,5 - dimethyl - 2 - pyrrol)methylene - 3,5 - dimethyl - 4 - isopyrrolepropionic acid, 5191⁴.
- C₁₁H₁₁CINO₁ - 2H₂O See *Dionine*.
- C₁₁H₁₁INO₁ (p - Hydroxyphenethyl)trimethyl ammonium iodide, α - toluate, 1269⁴.
- C₁₁H₁₁INO₁ Methiodide, m. 167 8°, from compd m. 217 8°, 16431.
- C₁₁H₁₁INO₁ Isodihydrothebazone acid, meth iodide, 16441.
- C₁₁H₁₁INO₁ Thebazone acid, hydroxydihydro , methiodide, 16431.
- C₁₁H₁₁N₁ Aniline, p, p' - (3 - methylcyclohexylidene)bis-, and -HCl, 46881.
- C₁₁H₁₁N₁O₁ (See also *Quinamine*.)
- Isquinoline, 1 - (2 - amino - 3,4 - dimethoxybenzyl) - 1,2,3,4 - tetrahydro - 2 - methyl -, di-HCl, 2980⁴.
- 1 - (2 - aminocyclopropyl) - 1,2,3,4 - tetrahydro-2-methyl-, 2981⁴.
- C₁₁H₁₁N₁O₁ Urea, α - (benzyl - phenoxypropyl) , 2419⁴.
- C₁₁H₁₁N₁O₁ 4 - Isopyrrolecarboxylic acid, 2 - (4 - carboxy - 3,5 - dimethyl - 2 - pyrrol)methylene - 3,5 - dimethyl -, di Et ester, and compd. with *SnCl₄*, 2968⁴.
- 1 - Isopyrrolepropionic acid, 2 - (4 - carboxy - 3,5 - dimethyl - 2 - pyrrol)methylene - 3,5 - dimethyl -, -HBr, 5191⁴.
- , 2 - [(4 - (β - carboxyethyl) - 3,5 - dimethyl - 2 - pyrrol)methylene] - 3,5 - dimethyl, salts, 1134⁴.
- Sinomenine, oxime, 3709⁴.
- C₁₁H₁₁N₁O₁ Compd. from Hansen's acid, 1387⁴.
- C₁₁H₁₁N₁O₁ Dihydro deriv. of acid from Hansen's acid, and salts, 1387⁴.
- C₁₁H₁₁N₁O₁ Compd. from Hansen's acid, 1387⁴.
- C₁₁H₁₁N₁O₁ Purimidine nucleoside, m. 221°, 3930⁴.
- C₁₁H₁₁N₁O₁ Pseudothibainone, semicarbazone, 3710⁴.
- C₁₁H₁₁N₁O₁ Fructose, 3-methyl, phenylsazone, 4451⁴.
- Glucose, 3-methyl, phenylsazone, 4450⁴.
- C₁₁H₁₁O₁ Ether, α - anylbenzohydril methyl, 5181⁴.
- Ketone, m. 108 10°, from phenylid *tert* butylethynylcarbinol, 1893⁴.
- 3,6 - Nonadiene - 5 - ol, 2,2,8,8 - tetramethyl-5-phenyl-, 1893⁴.
- 1 - Pentanol, 2 - phenethyl - 5 - phenyl -, 2934⁴.
- Δ - 1 - Propenone, 1 - 2 - camphanyl - 3 - phenyl-, 24331.
- C₁₁H₁₁O₁ 1,3 - Propanedione, 1 - 2 - camphanyl - 3-phenyl-, 24331.
- C₁₁H₁₁O₁ α - Crocetin, dihydro-, 32271.
- C₁₁H₁₁O₁ Glucoside, 3,4,6 - triacetyl - β - benzyl-, 1881⁴.
- C₁₁H₁₁O₁S Glucose, 3 - p - toluenesulfonyl-triacetyl-, 103⁴.
- C₁₁H₁₁BrN₁ Δ - 2 - Butenone, 4 - (2,4,6 - tri-

- methyl - Δ^3 - cyclohexenyl) -, *p* - bromophenyldiazone, 3692⁷.
- C₁₉H₂₅N Toluidine, dicyclohexenyl-, 4688^{2,3}.
- C₁₉H₂₅NO₂ Isodihydrosinomenine, 3710⁴.
- Sinomenine, dihydro -, 3709⁸.
- C₁₉H₂₅NO₂ Mannoheptonitrile, hexaacetyl -, 2942².
- C₁₉H₂₅BrN₂ Isopyrrole, 5 - (bromomethyl) - 2 - [(3,4 - (bromomethyl) - 3,4 - diethyl - 2 - pyrrol)methylene] - 3,4 - diethyl -, 2184⁷.
- C₁₉H₂₅ClN₂O₂ *p*, *p'* - Methylenebis(trimethylphenylammonium)sulfate, P 1910⁹.
- C₁₉H₂₅INO₂ Sekisanoline, methiodide, 4223⁸.
- C₁₉H₂₅N₂ 1,1'(2,2') - Biquinoline, 3,4,7,8-, 3',4',7',8' - octahydro - 7 - methyl -(?), and salts, 132².
- C₁₉H₂₅N₂O₂ Pyrrole, 2,2' - methylenebis[4 - acetyl - 3 - ethyl - 5 - methyl -, 2184².
- C₁₉H₂₅N₂O₂ Isodihydrosinomenine, oxime, 3710⁴.
- 2 - Pyrrolocarboxylic acid, 5,5' - methylenebis[3,4-diethyl-, 2184².
- C₁₉H₂₅N₂O₂ Nipecotic acid, 1 - butyl - 4 - hydroxy-, Et ester, *p*-nitrobenzoate, -HCl, P 3478¹.
- Nipecotic acid, 4 - hydroxy - 1 - isobutyl -, Et ester, *p* - nitrobenzoate, -HCl, P 3478¹.
- C₁₉H₂₅N₂O₂ Acid from Hansen's acid, 1387⁴.
- C₁₉H₂₅O 1 - Propanone, 1 - 2 - (amphanyl - 3 - phenyl-, 2433².
- C₁₉H₂₅O₂ Cyclohexanol, 4 - (*p* - hydroxy - α , α - dimethylbenzyl)-, diacetate, 4689⁴.
- C₁₉H₂₅O₂ 1,3,3 - Butanetricarboxylic acid, 4 - phenyl -, tri-Et ester, 2710².
- C₁₉H₂₅IN₂O₂ [*p* - (*p* - Dimethylamino - α , β - dihydroxyphenethyl)phenyl] trimethylammonium iodide, 124¹.
- C₁₉H₂₅NO₂ Compd., m 42.1², from *p*-cresol and piperidine, 123¹.
- Des - *N* - methyldeoxytetrahydrosinomenine, 3709⁸.
- 1 - Propanol, 1 - phenyl - 2 - (cyclydene oximino)-, 420².
- C₁₉H₂₅NO₂ 3 - Pyrrolocarboxylic acid, 1 - (3 - amphoryl) - 2,5 - dimethyl -, Et ester, 2961¹.
- C₁₉H₂₅NO₂ Nipecotic acid, 1 - butyl - *p* - hydroxy-, Et ester, benzoate, -HCl, P 3477².
- Nipecotic acid, 4 - hydroxy - 1 - isobutyl -, Et ester, benzoate, -HCl, P 3477².
- C₁₉H₂₅NO₂ Malonic acid, α -benzamidoamyl -, di-Et ester, 1617².
- C₁₉H₂₅NO₂ Rhamnohexanamide, hexaacetyl -, 2942².
- C₁₉H₂₅ Toluene, dicyclohexenyl-, 4936².
- C₁₉H₂₅ClIN₂O Δ^1 - 3 - Dodecenone, 1 - (*o* - chlorophenyl)-, semicarbazone, 116².
- C₁₉H₂₅INO₂ Desoxytetrahydrosinomenine, methiodide, 3709⁸.
- C₁₉H₂₅INO₂ Des - methoxydihydrosinomeninol, methiodide, 3710⁴.
- Thebainol, dihydro-, methiodide, 3710⁴.
- C₁₉H₂₅N₂ Isopyrrole, 2 - [(3,4 - diethyl - 5 - methyl - 2 - pyrrol)methylene] - 3,4 - diethyl - 5 - methyl -, and salts, 2184⁷.
- C₁₉H₂₅N₂O₂ Nipecotic acid, 1 - butyl - 4 - hydroxy-, Et ester, *p* - aminobenzoate, di-HCl, P 3478¹.
- Nipecotic acid, 4 - hydroxy - 1 - isobutyl -, Et ester, *p* - aminobenzoate, di-HCl, P 3478¹.
- C₁₉H₂₅N₂O₂ Norvaline, *N* - [α - (*N* - phenylcarbamylglycylamino)valeryl]-, 2092².
- C₁₉H₂₅N₂O₂ Dihydrazide, m. 265-8², of compd from Hansen's acid, 1387⁴.
- C₁₉H₂₅O₂ Methane, (linallyloxy)phenethyloxy -, 1871².
- C₁₉H₂₅O₂ Rhodinol, ester with phenethyl acid carbonate, 124⁷.
- C₁₉H₂₅O₂ α -Crocetin, hexahydro-, 3227¹.
- C₁₉H₂₅NO $\Delta^{2,4}$ - isononadienylamino)ethyl]-, -HCl, 4205⁴.
- C₁₉H₂₅NO₂ Anthranilic acid, *N*, *N* - dimethyl - menthyl ester, 2960¹.
- C₁₉H₂₅NO₂ Undercyclic acid, α -hydroxy -, Me ester, carbanilate, 1388².
- C₁₉H₂₅NO₂ Protocatechuy alcohol, α - (heptylaminomethyl) -, 3,4 - diacetate, 5162².
- C₁₉H₂₅NO₂ Glucosidyl piperidine, tetraacetyl - and -HCl, 4450².
- C₁₉H₂₅N₂O Quinoline, diethylaminoamylamino, methoxy-, P 1218².
- C₁₉H₂₅N₂O₂ Leucine, *N* - (*N* - phenylcarbamylnorleucyl)- 3210².
- Norleucine, *N* - (*N* - phenylcarbamylleucyl)-, 3210².
- , *N* - (*N* - phenylcarbamylnorleucyl) 3210².
- C₁₉H₂₅ClNO₂ 5 - Benzoyl - 2,3,6 - trimethylglucosidotrimethylammonium chloride, 1116².
- C₁₉H₂₅N₂O₂ Ornithine, *N*, *N'* - bis(cyclohexylcarbonyl) - γ - hydroxy - γ - lactone, 4216².
- C₁₉H₂₅O₂ Noragathic acid, 3711⁴.
- C₁₉H₂₅N₂O₂ Glycoxyamidine, 5,5' - 1,4 - butylenebis -, α - aminotetrahydro - 2 - imino - γ - keto - 4 - imidazoleoptoc acid salt, 1621⁴.
- C₁₉H₂₅O₂ Phthalic acid, Bu methylcyclohexyl ester, P 1138².
- C₁₉H₂₅P Phosphine, disocetyl - *p* - tolyl - and HgCl₂ compd., 4442².
- C₁₉H₂₅IP Disocetylvinethylphenylphosphonium iodide, 4412².
- C₁₉H₂₅O₂ Eleostearic acid, Me ester, 2152².
- Linoleic acid, Me ester, 534², 2422².
- Noragathic acid, tetrahydro-, 3711⁴.
- Octadecadienic acid, Me ester, 4192².
- C₁₉H₂₅N₂ 1,1'(2,2') - Biquinoline, 3 - amino - hexadecahydro - 2 - methyl -, (?), 132².
- C₁₉H₂₅Br₂O₂ Palmitic acid, β , β' -dibromopropyl ester, 2152², β , β' -dibromopropyl ester, 2152².
- C₁₉H₂₅O Cyclononadecanone, 1111².
- C₁₉H₂₅O Cyclohexanetricidecoic acid, P 818².
- Oleic acid, Me ester, 534², 2422².
- Palmitic acid, allyl ester, 2152².
- C₁₉H₂₅O₂ Ricinoleic acid, Me ester, 1616².
- C₁₉H₂₅O₂ Margaric acid, π - hydroxy -, acetate, 3664⁴.
- C₁₉H₂₅BrO₂ Nonadecanoic acid, α -bromo -, and Me ester, and -HCl, 603².
- C₁₉H₂₅O₂ 2 - Hexadecanone, 6,10,14 - trimethyl - 3702².
- C₁₉H₂₅O₂ Caprylic acid, nonyl ester, 4926².
- Propionic acid, cetyl ester, 4926².
- C₁₉H₂₅O₂ Nonadecanoic acid, α -hydroxy -, 3664⁴.
- Stearic acid, *p* - hydroxy -, Me ester, 3664⁴.
- C₁₉H₂₅O₂ Palmitin, α -mono-, 1876².
- C₁₉H₂₅NO Acetamide, *N*-heptadecyl-, 2410².
- C₁₉H₂₅N₂O 2 - Pentadecanone, 6,10,14 - trimethyl-, semicarbazone, 3702².
- C₁₉H₂₅ Nonadecane, 4438².

- $C_{20}H_8Br_4O_4$ 3, 4, 9, 10 - Perylenetetrone, tetra-bromo-, 2436⁵
- $C_{20}H_8Br_2N_2O_4$ 5, 6, 12, 13(7, 14) - α - Quinacridinetetrone, 1, 3, 8, 10 - tetrabromo-, 2444⁵
- $C_{20}H_8Br_2O_2$ Binaphthylene dioxide, tetrabromo-, 3458⁹
- $C_{20}H_8Cl_6$ Perylene, hexachloro-, 1351¹
- $C_{20}H_8I_2NaO_4$ sodium salt - see *Erythrosin*
- $C_{20}H_8Br_2N_2O_4$ Perylene, 3, 9 - dibromo - 4, 10 - dinitro-, 4212²
- 5, 6, 12, 13(7, 14) - α - Quinacridinetetrone, dibromo-, 2444⁵
- $C_{20}H_8Br_2O_2$ Binaphthylene dioxide, dibromo-, 3458⁹
- $C_{20}H_8Br_2O_2$ See *Loxin*
- $C_{20}H_8Cl_2O_2$ Binaphthylene dioxide, dichloro-, 3458⁹
- $C_{20}H_8Cl_2O_4$ 1, 2 - Benzantrhene 4, 5 - dicarboxylic acid, dichloro - 7, 12 - dihydro - 7, 12 - diketone-, P 1419²
- $C_{20}H_8Cl_4$ Perylene, tetrachloro-, 1351¹
- $C_{20}H_8Cl_4O_2$ Fluorescein, tetrachloro-, 3458⁹
- $C_{20}H_8N_2O_4$ Binaphthylene dioxide, dinitro-, 3459¹
- $C_{20}H_8O_4$ 1, 1' - Dinaphthylene 2, 8', 2', 8 - dioxide, 4, 4' - quinone-, P 2990¹
- 1, 1, 9, 10 Perylenetetrone-, 2136¹, 4212²
- $C_{20}H_8BrN_2O_4$ 5, 6, 12, 13(7, 14) - α - Quinacridinetetrone, bromo-, 2444⁵
- $C_{20}H_8ClN_2O_4$ 5, 6, 12, 13(7, 14) - α - Quinacridinetetrone, chloro-, 2444⁵
- $C_{20}H_8Br_2$ Perylene, 3, 9 - dibromo - 1, 5 - 1
- $C_{20}H_8Br_2O_4$ Fluorescein, dibromo-, 3458⁹
- $C_{20}H_8Br_2N_2O_4$ Anthranilic acid, N, N' - 2, 5 - diketo - p - phenylene bis(3, 5 - dibromo-, 2444⁵
- $C_{20}H_8Cl_4$ Perylene, 3, 9 - dichloro-, 1, 5 - 1
- $C_{20}H_8Li_2O_4$ Phenolphthalein, tetranodo-, 2757¹, P 1777²
- $C_{20}H_8N_2O_4$ Perylene, dinitro-, P 115¹, P 1139¹, 3926¹
- 5, 6, 12, 13(7, 14) - α - Quinacridinetetrone, 2444⁵
- $C_{20}H_8N_2O_4$ 5, 6, 12, 13(7, 14) - α - Quinacridinetetrone, dihydroxy-, 2444⁵
- $C_{20}H_8O_2$ Binaphthylene dioxide, 3458⁹
- 1, 1' - Dinaphthylene - 2, 8', 2', 8 - dioxide 8334, P 2990¹
- Perylenequinone, P 613¹, 3926¹, 4212²
- $C_{20}H_8O_2PbS_2$ 2 - Naphthol, 3, 3' - dithiols [6, 8 - dimercapto - Pb deriv., 1129¹
- $C_{20}H_8O_2PbS_2$ 2 - Naphthol, 3, 6, 8 - trimercapto - Pb deriv., 1129¹
- $C_{20}H_8O_4$ Dinaphthofurandione, SEE²
- $C_{20}H_8O_4$ 1, 2 - Benzantrhene 4, 5 - dicarboxylic acid, 7, 12 - dihydro - 7, 12 - diketone-, P 1419²
- $C_{20}H_8BrNO_2$ Spiro[ethylene oxide - $\alpha, 9'$ - fluorene], 2', 7' - dibromo - β - (p - nitrophenyl), 3919¹
- $C_{20}H_8NO_2$ 2, 3 - α - Naphthocarbazole - 5, 6 - dione, 4694⁴
- $C_{20}H_8NO_2$ Spiro[furo[3, 4 - γ pyridine - 1(3), 9' - xanthen] - 3 - one, 1', 3', 6', 8' - tetrahydroxy-, 5320²
- $C_{20}H_8NO_2$ Spiro[furo[3, 4 - γ pyridine - 1(3), 9' - xanthen] - 3 - one, 1', 3', 6', 8' - tetrahydroxy-, 5320²
- $C_{20}H_8N_2O_4$ 5-Acridinenitrile, picrate, 144¹
- $C_{20}H_8NaO_4$ sodium salt - see *Uranin*
- $C_{20}H_8$ See *Perylene*
- $C_{20}H_8BrN_2$ 3, 9 - Perylenediamine, 4, 10 - dibromo-, 4212²
- $C_{20}H_8Br_2O_2$ Benzene, bis(1 - bromobenzoyl) - 2, 3922¹
- $C_{20}H_8Br_2S_2$ Disulfide, bis(1 - bromo - 2 - naphthyl), 2172³
- $C_{20}H_8Br_2O_2S_2$ 2, 3, 6, 7 - Thianthrene-tetrol, 1, 4, 5, 8 - tetrabromo-, tetraacetate, disulfone, 3468²
- $C_{20}H_8ClO_2P$ 1, 1' - Bi - 2 - naphthol, cyclic chlorophosphate, 1897²
- $C_{20}H_8ClO_2P$ 1, 1' - Bi - 2 - naphthol, cyclic chlorophosphate, 1897²
- $C_{20}H_8ClN_2$ 3, 9 - Perylenediamine, 4, 10 - dichloro-, 4212²
- $C_{20}H_8ClN_2O_4$ Hystazarin, 1, 4 - bis(trichloroacetamidomethyl) -, 2177³
- $C_{20}H_8FeKO_4$ + 4H₂O, 1362²
- $C_{20}H_8FeNaO_4$ + H₂O, 1362²
- $C_{20}H_8NO$ *meso*-Anthrapyrazolone, phenyl, P 2014²
- $C_{20}H_8N_2O_2$ Naphthazalone, (2 - keto - 3(2) - indolylene) -, 4916¹
- $C_{20}H_8N_2O_4$ 5, 6, 12, 13(7, 14) - α - Quinacridinetetrone, diamino-, 2444⁵
- $C_{20}H_8N_2O_4$ 7, 8 - Acenaphthimidazole, 8 - p - amyl - 3, 4 - dinitro-, 2964⁴
- $C_{20}H_8N_2O_4$ *o* - Phenylenediamine, N, N' - bis-2, 4-dinitrobenzyl -, 4682²
- $C_{20}H_8N_2O_6$ Phthalaz - 1 - one, nitro - 3 - phenyl-, picrate, 145¹, 146¹
- $C_{20}H_8O$ Dinaphthofuran, 833¹, 1897²
- $C_{20}H_8OS$ α, α' - Dibenzophenothoxim, 2172³
- $C_{20}H_8O_4$ 1, 2 - Benzantrhene - 7, 12 - dione, 5 - hydroxy -, acetate, 5472²
- 1, 4 - Naphthoquinone, 2 - hydroxy - 3 - 2 - hydroxy - 1 - naphthyl -, 833¹
- $C_{20}H_8O$ See *Fluorescein*
- $C_{20}H_8O$ Gallin, 3458⁹
- $C_{20}H_8O_4$ 1, 5 - Anthraquinone dicarboxylic acid, dianhydride with acetic acid, 2711¹
- $C_{20}H_8AsClNa'$ - Dibenzophenarsazine, 11 - chloro - 7, 14 - dihydro-, 4474⁸
- $C_{20}H_8BrINO_2$ 1 (1 Iodo - 2 - anthraquinonyl - methylpyridinium bromide, 2711¹
- $C_{20}H_8BrNO_2$ 1 - (1 - Nitro - 2 - anthraquinonyl - methylpyridinium bromide, 2711¹
- $C_{20}H_8BrOS$ 2 - Naphthol, 1 - (1 - bromo - 2 - naphthylmercapto) -, 2172³
- $C_{20}H_8BrO_4$ Compd., m. 222°, from bromine and 2 - (3, 4 - methylenedioxystyryl) - 6 - phenyl-194-pyrene, 143¹
- $C_{20}H_8ClO_4$ 1, 2 - Benzofuranone, 2 - (p - chlorophenyl) - 2 - (2, 1 - dihydroxyphenyl) - 5 - hydroxy -, 4691⁴
- $C_{20}H_8FeO_4$ + 2H₂O, 1362²
- $C_{20}H_8IO_4$ Phenolphthalein, iodo -, 3457⁹
- $C_{20}H_8N_2$ 2, 3 - α - Naphthocarbazole, 4694⁴
- $C_{20}H_8NO$ Benz[3, 4]anthr[1, 2]oxazole, 2 - methyl-, 5472²
- $C_{20}H_8NO$ Spiro[ethylene oxide - $\alpha, 9'$ - fluorene], β - nitrophenyl -, 3919¹
- $C_{20}H_8NO$ Benzonitrile, β, β' - iminobis(m - arcylyl) -, 827²
- $C_{20}H_8N_2O_4$ 7, 8 - Acenaphthimidazole, 8 - (4 - hydroxy - m - amyl) - 4 - nitro -, 2964⁴
- $C_{20}H_8N_2O_4$ 5-Acridanenitrile, picrate, 145¹
- $C_{20}H_{14}$ Binaphthyl, 1129¹
- Fluorene, 9-benzal, 3917¹
- $C_{20}H_{14}AsBr$ Arsine, bromodi - 1 - naphthyl -, 2955²
- $C_{20}H_{14}AsI$ Arsine, iododi - 1 - naphthyl -, 2955²
- $C_{20}H_{14}Br_2O_4$ 4, 4' - Biresorcinol, 2, 2', 6, 6' - tetrabromo-, tetraacetate, 1401⁶
- $C_{20}H_{14}ClNO_4$ 3, 5 - Benzofurandiol, 2 - (p -

- chlorophenyl) - 1, 2 - dihydro - 1 - imino - 2 - (2, 4, 6 - trihydroxyphenyl) -, and -HCl, 4691¹.
- C₂₀H₁₁ClN₅O₁₁ Aniline, *N* - (5 - chlorovanillal) - *m*-nitro-, picrate, 4456⁴.
- C₂₀H₁₁Cl₂N₅O₁₁ Thionaphthalenealdehyde, chlorohydroxymethyl-, azine, P 2447¹.
- C₂₀H₁₁Cl₂N₅O₁₁ Aniline, *p* - chloro - *N* - (5 - chlorovanillal) -, picrate, 4456⁴.
- C₂₀H₁₁Cl₂O₁₁ 1, 5 - Anthraquinonedicarboxylic acid, 4, 8 - dichloro -, di-Et ester, 4944⁴.
- C₂₀H₁₁Hg Mercury di - 1 - naphthyl, 5172¹.
- C₂₀H₁₁N₅ Perylenediamine, 2438⁴, 3926⁴, 4212¹.
- peri* - Quinacridine, 6 - methyl -, 1131¹.
- C₂₀H₁₁N₅O 7, 8 - Acenaphthimidazole, 8 - *p* - anisyl -, 2964¹.
- C₂₀H₁₁N₅O 7, 8 - Acenaphthimidazole, 8 - (4 - hydroxy - *m* - anisyl) -, 2964¹.
- Anthraquinone, 1 - amino - 4 - anilino -, 1273¹.
- Phthalimide, *N* - [*p* - (*p* - aminophenyl)phenyl] -, 127⁴.
- C₂₀H₁₁N₅O₁₁ 2(3) - α - Naphthazalone, 3 - (2, 3 - dihydro - 2 - keto - 3 - mercapto - 3 - indyl) - 3 - mercapto -, 4946⁴.
- C₂₀H₁₁N₅O 2(3) - α - Naphthazalone, 3 - (2, 3 - dihydro - 2 - keto - 3 - indyl) - 3 - hydroxy -, 4946⁴.
- C₂₀H₁₁N₅O 2, 5 - Piperazinedione, 3, 6 - dipiperonylidene -, 5489¹.
- C₂₀H₁₁N₅O₁₁ + H₂O Naphtholsulfonic acid, naphthylazo -, acid sulfite, *di-Na salt*, 3462⁴.
- C₂₀H₁₁N₅O₁₁ + H₂O 2 - Naphthol - 3, 6 - disulfonic acid, naphthylazo -, acid sulfite, *tri-Na salt*, 3462⁴.
- 2 - Naphthol - 6 - sulfonic acid, sulfonaphthylazo -, acid sulfite, *tri-Na salt*, 3462⁴.
- C₂₀H₁₁N₅O₁₁ + H₂O Naphtholdisulfonic acid, sulfonaphthylazo -, acid sulfite, *tetra-Na salt*, 3462⁴.
- C₂₀H₁₁N₅O₁₁ + H₂O 2 - Naphthol - 3, 6, 8 - trisulfonic acid, sulfonaphthylazo -, acid sulfite, *penta-Na salt*, 3462⁴.
- C₂₀H₁₁N₅O 1, 2, 4 - Triazol - 5(4) - one, 3 - (nitrophenyl) - 1, 4 - diphenyl -, 3683⁴.
- C₂₀H₁₁N₅O₁₁ 2 - Methyl - 1 - phenylbenzothiazolium picrate, 142¹.
- C₂₀H₁₁O Ketone, 9-fluorophenyl, 3917¹.
- Naphthindanone, benzyl-, 2707¹.
- Spiro[ethylene oxide - 9', 9' - fluorene], β - phenyl-, 3919¹.
- * C₂₀H₁₁O H₂ - Benzanthren - 5 - ol, acetate, 5472¹.
- Benzil, β -phenyl-, 3923⁴.
- 1, 1' - Bi - 2 - naphthol, 1807¹.
- Phthalide, 2, 2-diphenyl-, 132¹.
- C₂₀H₁₁O₁₁ 2-Naphthyl sulfone, 3924⁴.
- C₂₀H₁₁O₁₁ 2 - Naphthol, 3, 3' - dithiobis[6, 8 - dimercapto-, 1129¹.
- C₂₀H₁₁O₁₁ 2 - Naphthol, 1, 1' - selenobis -, 2189¹.
- C₂₀H₁₁O (See also Phenolphthalein.)
- 1, 4 - Pyrone, 2 - (3, 4 - methylenedioxy aryl) - 6 - phenyl -, 143¹.
- C₂₀H₁₁O₁₁ 1 - Naphthalenesulfonic acid, 8, 8' - dithiobis -, 135¹.
- C₂₀H₁₁O₁₁ Fulvic acid, β , β' - dimethoxy -, lactone, 1128¹.
- C₂₀H₁₁O₁₁ Benzoic acid, α , α' - (dihydroxyphenylenedithio)bis -, 826¹.
- C₂₀H₁₁O₁₁ 1 - Naphthalenesulfonic acid, 8, 8' - dithiobis -, and *di-Na salt*, 135¹.
- C₂₀H₁₁O₁₁ Coumarin, 5, 7 - dihydroxy - 3 - (3, 4 - methylenedioxyphenyl) -, diacetate, 1834¹.
- Phenanthrenequinone, trihydroxy-, triacetate, 3466⁴.
- C₂₀H₁₁S 2-Naphthyl sulfide, 3924⁴.
- C₂₀H₁₁BrO 2 - β - Tolueneone, 6 - bromo - 4 - diphenylmethylen-, 3457¹.
- C₂₀H₁₁Cl₂N₅O₁₁ Terephthalanilide, 2 - (chloro mercuri) -, 4943¹.
- C₂₀H₁₁ClN₅O₁₁ Phenol, β - (5 - chlorovanillal amino) -, picrate, 4456⁴.
- C₂₀H₁₁ClO 2 - β - Tolueneone, 6 - chloro - 4 - diphenylmethylen-, 3457¹.
- C₂₀H₁₁N 2, 3 - α - Naphthocarbazole, 5, 6 - dihydro-, 4694¹.
- C₂₀H₁₁NO 5(10) - Acridone, 1 - methyl - 10 - phenyl -, 837¹.
- 5(10) - Acridone, 10 - *o* - tolyl -, 839¹.
- C₂₀H₁₁NO₁₁ Compd., m. 155-7°, from Ac₂O and 2 - hydroxynaphthyl - 1 - glyoxal dianil, 2951¹.
- C₂₀H₁₁NO 3, 5 - Benzo furandiol, 1, 2 - dihydro - 1 - imino - 2 - phenyl - 2 - (2, 4, 6 - trihydroxyphenyl) -, and -HCl, 4691¹.
- Phenanthrenequinone, 4 - (diacetyl amino) - 3 - hydroxy -, acetate, 3466⁴.
- C₂₀H₁₁N₅O₁₁ Anthraquinone, amino-amino-phenyl-, P 2577¹.
- C₂₀H₁₁N₅O₁₁ Phenanthrone, dihydro-, picrate, 3703¹.
- C₂₀H₁₁N₅O₁₁ Benzimidazole, 1 - benzyl -, picrate, 1638¹.
- C₂₀H₁₁N₅O₁₁ Tetryl, compd. with fluorene, 3214¹.
- C₂₀H₁₁ Ethylene, (triphenyl), 1794¹, 3906¹.
- C₂₀H₁₁Cl₂N₅O₁₁ 2, 5 - Pyrazinedicarboxamide, 2', 2'', 5', 5'' - tetrachloro - 2, 5 - dihydro - 3, 6 - dimethyl -, 835¹.
- C₂₀H₁₁F₁₁O₁₁ + 4H₂O, 1362¹.
- C₂₀H₁₁N₅ 1, 1' - Bi - 2 - naphthylamine, 2962¹, 3698¹.
- C₂₀H₁₁N₅O 5(10) - Acridone, 4 - anilino - 1 - methyl-, 1131¹.
- C₂₀H₁₁N₅O₁₁ Benzoyl deriv., m. 150°, of reduction product of pyocyanin, 2717¹.
- Naphthalimide, *N* - (*N* - ethylanilino) 4214¹.
- Succinonitrile, α , β - diacetyl - α , β - diphenyl-, 1126¹.
- C₂₀H₁₁N₅O₁₁ 1, 1' - Bithionaphthene, 2, 2' - diacetamido-, 3468¹.
- C₂₀H₁₁N₅O₁₁ Phenol, β - (β - anisylazo) benzene, 1397¹.
- C₂₀H₁₁N₅O₁₁ Ketiponitrile, α , β - di - β - anilino -, 1128¹.
- C₂₀H₁₁N₅O₁₁ Isatin pinacol, diacetyl -, 2970¹.
- C₂₀H₁₁N₅O 1, 2, 4 - Triazol - 5(4) - one, 3 - (aminophenyl) - 1, 4 - diphenyl -, 3683⁴.
- C₂₀H₁₁N₅O₁₁ Benzaldehyde, nitro-, 2, 4 diphenyl semicarbazone, 3682⁴, 42¹.
- C₂₀H₁₁O Benzophenone, *o*-benzyl-, 1409¹.
- 1 - Indanone, 2 - (1 - naphthylmethyl) -, 2707¹.
- Naphthindanone, benzyl-, 2707¹.
- Phthalan, diphenyl-, 1409¹.
- 2 - β - Tolueneone, 4 - diphenylmethylen-, 3457¹.
- C₂₀H₁₁O₁₁ Acetic acid, diphenyl-, Ph ester, 4454¹.
- Acetic acid, triphenyl-, 2637¹.
- β - Benzenone, 4 - diphenylmethylen- - 2 - methoxy-, 3457¹.
- β (or β')-phenyl-, 3923⁴.

- C₂₀H₁₈O₂** Cinnamic acid, *p* - methoxy -, 2-naphthyl ester, 24321.
C₂₀H₁₈O₂S 2 - Fluorenoyl, *p* - toluenesulfonate, 46911.
C₂₀H₁₈O₄ Compd., m. 152-3°, from 3 - allyl - 4 - methylumbelliferone and Ac₂O, 2959⁹.
 6 - Dibenzopyrone, 7,8,9,10 - tetrahydro-3-hydroxy -, benzoate, 383⁵.
 Quinone, 2,6 - bis(benzyloxy) -, 2181.
C₂₀H₁₈O₂S Thioindigo, 5,5' - diethoxy -, p. 3477².
C₂₀H₁₈O₄ Phenanthrenetriol, triacetate, 3466⁴.
 Quinone, 2,5 - bis(*p* - hydroxyphenyl) - 3,6 - dimethoxy -, 1127⁸.
 —, 2,5 - di - *p* - anisyl - 3,6 - dihydroxy -, 1127⁸, 1128⁸.
C₂₀H₁₈O₂ Atromentic acid, Et ester, 1128⁸.
C₂₀H₁₈O₄S 2,3,6,7 - Thianthrenetetrrol, tetraacetate, 3468¹.
C₂₀H₁₈O₄S 2,3,6,7 - Thianthrenetetrrol, tetraacetate, 9-oxide, 3468¹.
C₂₀H₁₈O₆S 2,3,6,7 - Thianthrenetetrrol, tetraacetate, 9,9-dioxide, 3468².
C₂₀H₁₈O₁₀S 2,3,6,7 - Thianthrenetetrrol, tetraacetate, 9,9,10,10 - tetraoxide, 3468².
C₂₀H₁₇BrO 2,4 - Xylenol, 6 - bromo - *o*,*o* - diphenyl -, 3457⁷.
C₂₀H₁₇BrO Carbinol, 15 - bromo - 4,4 - cresyl - diphenyl -, 3457⁷.
C₂₀H₁₇ClO Cyclohexenone, 3 - *o* - chlorotolyl -, 5-phenyl -, 831³.
 Methane, 5 - chloro - *o* - anisylidiphenyl -, 1129¹.
 2,4 - Xylenol, 6 - chloro - *o*,*o* - diphenyl -, 3457⁷.
C₂₀H₁₇ClO Carbinol, 5 - chloro - *o* - anisylidiphenyl -, 1129¹.
 Carbinol, (5 - chloro - 4,3 - cresyl)diphenyl -, 3457⁷.
C₂₀H₁₇ClO Umbelliferone, 3 - (chloropropyl) - 4 methyl-, benzoate, 2959⁹.
C₂₀H₁₇NO Benzamide, *N* - *o* - phenylbenzyl -, 2710².
 Benzamide, *N* - phenyl - *N* - *m* - tolyl -, 4704².
 Benzimidic acid, *N* - phenyl -, *m* - tolyl ester, 4704².
 —, *N* - *m* - tolyl-, Ph ester, 4704².
 2,9(b) - α - Naphthazalone, 3,9(b) - dimethyl - 1-phenyl-, 3699³.
 1 - *para* - Naphthindanone, 2 - benzyl -, oxime, 2707².
 2 - Naphthylamine, *N* - *p* - methoxycinnamal., 3911⁹.
C₂₀H₁₇NO Anthranilic acid, *N* - phenyl - *N* - *o* - tolyl-, 839⁹.
C₂₀H₁₇NO 1,2' - Bithionaphthene, 2 - diacetylamino - 1,2 - dihydro -, 3469¹.
C₂₀H₁₇NO (See also *Berberine*.)
 Benzene, 1,2 - bis(benzyloxy) - 4 - nitro -, 3677².
 Diacetamide, *N* - (hydroxyphenanthryl) -, acetate, 3469¹, 4468².
C₂₀H₁₇NO Benzil, 2,4 - dihydroxy -, oxime, triacetyl deriv., 833³.
C₂₀H₁₇N Δ^2 - 1,2,4 - Triazolinc, 1,3,4 - triphenyl-(?), 3663³.
C₂₀H₁₇N 1 - α - Naphthindanone, 3 - phenyl -, semicarbazone, 2707².
C₂₀H₁₇N Dibenzylamine, *m*,*m*' - dinitro - *N* - phenyl-, 3445⁹.
 Dibenzylamine, *N* - (2,6 - dinitrophenyl) -, 378².
C₂₀H₁₇N *p* - Toluenesulfonanilide, *N* - methyl - 2',6' - dinitro - 4' - phenyl -, 830².
C₂₀H₁₇N Phenanthrene, 1,2,3,4 - tetrahydro-, picate, 3703⁷.
C₂₀H₁₇N 2 - Anthrol, 1,2,3,4 - tetrahydro -, picate, 469⁹.
 Ketone, 2,6 - dimethyl - 1 - naphthyl methyl, picate, 3916¹.
C₂₀H₁₇N Semicarbazide, 1 - [*o* - (*o* - nitrobenzylamino)phenyl] - 4 - phenyl -, 379⁹.
C₂₀H₁₇N Guanidine, phenylthiocarbamidophenyl - *p* - phenylene -, 2158¹.
C₂₀H₁₈ Butadiene, di(2,1-xylyl), 2930⁹, 2931¹.
 3,5 - Octalene, 1,8 - diphenyl -, 2930⁹.
 Pervlene hexahydro -, 3223⁹.
C₂₀H₁₇As 1,4 - Benzoxazin - 3 - ol, ar-enol[acetanido -, 811, 842-.
C₂₀H₁₇Br *p* - Phenylenediamine, *N* - benzal - *N* - benzyl -, dibromide, 378².
C₂₀H₁₇ClO Phosphine, chloromethoxy-(triphenylmethoxy)-, 3921⁵.
 Phosphine oxide, chloromethoxy(triphenylmethyl)-, 3921⁵.
C₂₀H₁₇Cl 2,5 - Pyrazinedicarboxanilide, *o*,*o*' - dichloro - 2,5 - dihydro - 3,6 - dimethyl -, 845².
C₂₀H₁₇MoO Molybdyl bisbenzoylacetone, 1877⁵.
C₂₀H₁₇N 1,2 - Anthracenone, 3,4 - dihydro -, phenylhydrazine, 4694².
 —, Phenylendiamine, *N* - benzal - *N* - benzyl, and - HCl, 378².
C₂₀H₁₇N Benzamide, *p* - benzylamino-, 378².
 Benzoic acid, β - phenyl - β - *p* - tolylhydrazide, 4938⁸.
C₂₀H₁₇N Acetophenone, *p* - (2-ethoxy-1-naphthylazo) -, 3461⁴.
 Anthranilic acid, *N* - (5 - amino - *o* - tolyl) -, 1131².
 Benzoic acid, β - *p* - anisyl - β - phenylhydrazide, 4938⁸.
 Dibenzylamine, *N* - (nitrophenyl) -, *ana* HCl, 378².
 2 - *o* - Piperazinedione, 3,6 - bis(*m* - methylbenzyl) -, 5469².
C₂₀H₁₇N Carbazole, 9 - benzoyl - 1,2,3,4 - tetrahydro - 3 - methylnitro -, 139⁴.
C₂₀H₁₇N 2,5 - Piperazinedione, 3,6 - bis-methoxybenzyl -, 4684².
C₂₀H₁₇N *p* - Toluenesulfonanilide, *N* - methyl - 4 - nitro - 2' - phenyl -, 830².
C₂₀H₁₇N Isophthalic acid, 5 - nitro - di-Me ester, compd. with 1 - naphthylamine, 2428².
C₂₀H₁₇N 1,3 - Cyclohexanediol, bis(*p* - nitrobenzoate), 4677².
C₂₀H₁₇N Anthramine, tetrahydro -, picate, 4695⁷.
C₂₀H₁₇N Compd., m. 172°, from phenylhydrazine and PhNCS, 3445².
C₂₀H₁₇O Ether, benzyl benzylphenyl, 2955².
 Phenol, dibenzyl-, 2955².
 Xylenol, diphenyl-, 1633³, 3457⁸.
C₂₀H₁₇O Carbinol, 4,3 - cresylidiphenyl-, 3457⁷.
 Cresol, α , α - diphenyl -, 3457⁷.
 Isobutyric acid, β - naphthyl - β ' - phenyl -, 2707².
 Peryleneol, hexahydro-, 3223⁹.
C₂₀H₁₇O Benzene, *m* - bis(benzylsulfinyl) -, 4202⁴.
C₂₀H₁₇O Carbinol, 4 - hydroxy - *m* - anisylidiphenyl -, 3457⁷.

- C₂₀H₁₈O₄ Δ^{2,4} - 1,6 - Hexadienedicarboxylic acid, 1,6-diphenyl-, 5181⁴.
Hydroquinone, 2,6-bis(benzyloxy)-, 2181¹.
Δ^{2,4} - 1 - Pentadienone, 5 - *p* - anisyl - 1 - (*p* - hydroxyphenyl)-, acetate, 3911³.
- C₂₀H₁₈O₄ Cyclopentadienone, 2,5 - di - *p* - anisyl - 3 - hydroxy - 4 - methoxy -, 1128⁹.
- C₂₀H₁₈O₄ Benzoic acid, *o,o'* - oxalylbis -, di-Et ester, 1128⁷.
Sesamin, 597¹.
- C₂₀H₁₉ClO₄ 2 - Naphthoic acid, 3 - hydroxy - 4 - α - methoxybenzyl -, Me ester, oxonium-HCl, 3221⁴.
- C₂₀H₁₉IN₂S₂ 2 - Methyl - 1 - [β - methyl - (2 - methyl - 1(2) - benzothiazylidene)propenyl]benzothiazolium iodide, 1903³.
- C₂₀H₁₉N Dibenzylamine, *N*-phenyl-, 3445⁷.
- C₂₀H₁₉NO Carbazole, 9 - benzoyl - 1,2,3,4 - tetrahydro - 3 - methyl -, 139¹.
 α,γ,ϵ - Heptatrieno - *p* - toluidine, 5 - phenyl -, 3689¹.
Quinoline, 6 - (allyloxy) - 4 - ethyl - 2 - phenyl-, 2443³.
- C₂₀H₁₉NO₂ Acrylophenone, β,β' - iminobis- [β -methyl-, 827³.
Aniline, 3,4-bis(benzyloxy)-, 3677⁴.
 α,γ,ϵ - Heptatrien - *p* - aniside, 5 - phenyl -, 3689¹.
2(3) - α - Naphthazalone, 3 β ,9b - dihydro - 3a - methoxy - 9b - methyl - 1 - phenyl -, 3699¹.
Propionanilide, *N* - (1,2 - dihydro - 2 - keto - 1 - methyl - 1 - naphthyl) -, 3699².
- C₂₀H₁₉NO₂S *p* - Toluenesulfonanilide, *N* - methyl - 2' - phenyl-, 830¹.
- C₂₀H₁₉NO₂ Acrylophenone, β,β' - iminobis- [β -methoxy-, 827³.
5(4) - Oxazolone, 4 - (6 - ethylveratral) - 2-phenyl-, 843¹.
- C₂₀H₁₉NO₂ (See also *Chelidonine*.)
Protopine, 1215².
- C₂₀H₁₉NO₂ 1,2,4 - Benzenetriol, 6 - methyl - 3 - phenylimino-methyl-, trisacetate, 4478¹.
- C₂₀H₁₉N Anthramine, tetrahydrophenylazo-, 4695².
Guanidine, benzyldiphenyl-, P 847⁹.
- C₂₀H₁₉N₂O₂ Acetophenone, *p* - (2 - ethoxy - 1 - naphthylazo) -, oxime, 3461⁴.
Pyrazo[5,4 - γ]quinoline - 4,4(2,5) - dione, 3,5 - diethyl - 2 - phenyl -, 2443³.
- C₂₀H₁₉N₂O₂S Thiazole, 2 - acetamido - 5 - (4 - acetamido - *o* - tolyl) - 4 - phenyl -, 1416⁵.
Thiazole, 2 - amino - 5 - (4 - amino - *m* - tolyl) - 4 - phenyl -, diacetyl deriv., 1410⁵.
- C₂₀H₁₉N₂O₂ Δ² - Isoxazoline, 5 - (*o* - diacetylaminophenyl) - 4 - imino - 3 - methyl - 5-phenyl-, 2974¹.
- C₂₀H₁₉N₂O₂ Benzophenone, 2 - hydroxy - 5,5' - dinitro - 2' - (1 - piperidyl) -, acetate, 2182².
- C₂₀H₁₉N₃ Biguanide, α,β,γ - triphenyl-, 4931¹.
- C₂₀H₁₉N₃O₂ Semicarbazide, 4 - phenyl - 1 - [α - (β - phenylthiocarbamido)phenyl] -, 379⁹.
- C₂₀H₁₉N₃O₂ Acetophenone, *p* - (2 - methoxy - 1 - naphthylazo) -, semicarbazone, 8461¹.
Semicarbazide, 4 - phenyl - 1 - [α - (β - phenylthiocarbamido)phenyl] -, 379⁹.
- C₂₀H₁₉ Perylene, octahydro-, 3223¹.
- C₂₀H₁₉Br₂CoN₂ Diquinaldinium cobaltous bromide, 5125⁴.
- C₂₀H₂₀Cl₂N₂Pt, 209¹.
- C₂₀H₂₀Cl₂N₂O₂ Antipyrine, compd. with β - trichloroethyl carbanilate, 140⁹.
- C₂₀H₂₀Cl₂N₂Rh, 4217².
- C₂₀H₂₀Cl₂CoN₂ Diquinaldinium cobaltous chloride, 5125⁴.
- C₂₀H₂₀F₂IN₂, 353¹.
- C₂₀H₂₀N₂ 1,2 - Benzocamphorquinoxaline, 2170¹.
Phenylenediamine, *N,N* - dibenzyl -, *ana* Zn salt, 3783¹.
- C₂₀H₂₀N₂O₂ Acetamide, *N* - methyl - *N* - (4 - methylamino - 3 - phenyl - 2 - naphthyl) -, 4467⁴.
- C₂₀H₂₀N₂O₂ Cinchoninamide, *N,N* - diethyl - 2-phenoxy-, P 1217⁸.
Cinchonanilide, 2 - ethoxy - *N* - ethyl - P 1217⁸.
- C₂₀H₂₀N₂O₂S 1,1' - Bitluonaphthene, 2,2' - diacetamido - 1,1',2,2' - tetrahydro -, 3468⁷.
- C₂₀H₂₀N₂O₂ 1 - Naphthol, 1,3 - diacetamido - 1,2 - dihydro - 2 - phenyl-, 4467⁴.
- C₂₀H₂₀N₂O₂ *p,p'* - Biacetanilide, 835¹.
8a(4b) - Carbazolol, 9 - benzoyl - 5,6,7,8 - tetrahydro - 6 - methyl - 4b - nitro - 139¹.
- C₂₀H₂₀N₂O₂ Malonic acid, 5 - aminino - 1 - phenyl - imino - Δ^{2,4} - 2 - pentadienol salt, 2438¹.
- C₂₀H₂₀N₂O₂ Cinnamic acid, α - benzamido - 3,4 - dimethoxy - 2 - nitro -, Et ester, 2980⁹.
- C₂₀H₂₀N₂O₂ Bergenin, phenylazo-, 3699⁴.
- C₂₀H₂₀N₂O₂ 2,5 - Pyrazinedicarboxanilide, 2 - dihydro - 2,5 - dimethyl -, 835¹.
- C₂₀H₂₀N₂O₂ Isoquinoline, 6,7 - dimethoxy - 1 - propyl -, picrate, 2444¹.
- C₂₀H₂₀N₂NiO₂ Compd. of Ni(N₂O₂) and pyridine, 3180¹.
- C₂₀H₂₀O 2 - Butin - 1 - one, 1,4 - di(2,4 - cyclohexadienyl)-, 2931¹.
- C₂₀H₂₀OSn Stannane, benzylhydroxyphenyl - tolyl-, 118¹.
- C₂₀H₂₀O β -Butenic acid, α - (α - hydroxybenzyl - γ -phenyl-, Me ester, acetate, 1395¹.
1,3-Cyclohexanediol, dibenzoate, 4677¹.
Eugenol, *p*-methoxycinnamate, 2432¹.
 α,γ - Pentadienic acid, δ - *p* - anisyl - phenetyl ester, 3912³.
Phenanthrene, 3,4,6,7 - tetramethoxy - 1-vinyl-, 843¹.
- C₂₀H₂₀O₂ Malonic acid, α - phenacylbenzyl - mono-Et ester, 3210¹.
- C₂₀H₂₀O₂ *p* - Dioxanedicarbinol, dibenzoate, 2697¹.
- C₂₀H₂₀O₂ Flavanone, 5 - hydroxy - 3,4,7 - trimethoxy -, acetate, 4210⁴.
Hematoxylone, tetramethyl -, 150¹.
- C₂₀H₂₀O₂ Flavone, hydroxypentamethoxy -, 2181¹.
- C₂₀H₂₀O₂ Hemipic acid, 6 - (carboxyphenyl) - (tri-Me ester, 4222⁹.
- C₂₀H₂₁BrN₂O₂ Alanine, *N* - [*N* - (4 - bromo - hydrocinnamyl)glycyl] - β - phenyl -, 2992¹.
- C₂₀H₂₁Cl₂N ORh, 4217².
- C₂₀H₂₁IN₂O₂S 5 - Quinolinesulfonic acid, 8 - hydroxy - 7 - iodo -, Bu *p* - aminobenzoate compd., P 2535¹.
- C₂₀H₂₁NO Bensanilide, *p'* - methylcyclohexenyl -, 4689².
Carbazole, 9 - benzoylhexahydro - 3 - methyl -, 139¹.
Cycloheptindole, 10 - benzoyl - 4b,5,6,7,8,9,9a,10-octahydro-, 138¹.

- C₂₀H₂₁NO₂** 1,1 - Cyclopentanediacetimide, α - methyl - *N* - 2 - naphthyl - , 1107.
p - Phenetidine, *N* - (α - *p* - anisyl - Δ^2 - pentadienylidene) - , 39121.
C₂₀H₂₁NO₃ Homotrilobine, 3929, 52729.
 α, γ - Pentadieno - *p* - phenetide, δ - *p* - anisyl - , 39121.
C₂₀H₂₁NO₄ See *Canadine*; *Papaverine*.
C₂₀H₂₁NO₅ 1 - Propanol, 1 - (3,4 - diacetoxy phenyl) - 2 - (benzylideneoximino) - , 51627.
C₂₀H₂₂ Biphenyl, *p, p'* - di Δ^1 - butenyl - , 39083.
C₂₀H₂₂AsClN₂O₂ Quinine, arsinosochloro -, and salts, 39377.
C₂₀H₂₂BrNO₄ Codeinone, acetyl bromodihydro -, - *HBr*, P 54748.
C₂₀H₂₂Br₂O₂ Propiophenone, α, β - dibromo - 2 - isopropyl - 4 - methoxy - 5 - methyl - β - phenyl - , 11239.
C₂₀H₂₂Hg₂N₂O₂ Salicylic acid, Hg salt, Hg (CN)₂ compd., EtOH addn compd., 11151.
C₂₀H₂₂N₂ Pyrazine, 2,5 - dibenzyl - 2,5 - dihydro - 3,6 - dimethyl - , 18979.
C₂₀H₂₂N₂O₂ (See also *Galvamine*)
 Benzoic acid, *o* - (*o* - cyanophenyl) - β diethylaminoethyl ester, - *HCl*, 24336.
 2 - Benzosuberancarboxylic acid, 3 - keto - α - phenylhydrazono, 137.
 2,5 - Piperazinedione, 1,4 - dibenzyl - 3,6 - dimethyl - , 84074.
C₂₀H₂₂N₂O₄ Homoterephthal - 1 - amic acid, α - (*p* - dimethylaminobenzyl) - Et ester, 21769.
C₂₀H₂₂N₂O₄ 1,4 - Cyclohexanediol, dicarbamate, 11199.
p - Phenylenediamine, *N'* - (dimethoxymethylenedioxy)cinnamal - *N, N'* - di methyl - , 49400.
 2,5 - Piperazinedione, 1,4 - bis-*p* - methoxybenzyl - , 8407.
 1 - Piperidinol, 1 - phenethyl, *p* - nitrobenzoate, - *HCl*, 19029.
C₂₀H₂₃NO₃ Alanine, *N* - (*N* - carbomethoxy - β phenylalanyl) - β - phenyl - , 16189.
C₂₀H₂₃NO₄ Isoquinoline, 3,4 - dihydrodimethoxy - 1 - (nitroveratryl) - , 1479, 34738.
C₂₀H₂₃N₂S Carbanilide, *p* - methylcyclohexenyl thio, 46889.
C₂₀H₂₃N₂O Anthramine, octahydro -, picrate 46953.
 Compd., m. 197-8°, from 4 - methoxy - 3 nitrohydrocinnamamide, 47054.
C₂₀H₂₃NO₂ Isoquinoline, 3,4 - dihydro - 6,7 - dimethoxy - 1 - propyl - , picrate, 24447.
C₂₀H₂₃O Cyclohexanone, 2,6-dibenzyl - , 27029.
 Δ^1 - 3 - Octenone, 1,1 - diphenyl - , 41871.
 2 - Octin - 1 - ol, 1,1 - diphenyl - , 41871.
C₂₀H₂₃O Chalcone, 2' - isopropyl - 4' - methoxy - 5' - methyl - , 11239.
C₂₀H₂₃O₂ Cinnamic acid, *p* - methoxy -, carvacryl ester, 24321, thymyl ester, 24321.
C₂₀H₂₃O₂ Hydracrylic acid, α - phenethyl - β - phenyl -, Me ester, acetate, 13967.
 Malonic acid, phenethyl(γ - phenylpropyl) - , 29349.
 α - phenylbenzyl -, di-Et ester, 27101.
 Phenanthrene, 1 - ethyl - 3,4,6,7 - tetra methoxy -, 8433.
C₂₀H₂₃O₂ Carthamidin, β - methyl ether, 34717.
 Compd., m. 188-92°, from tetramethyl hematoxylone, 1508.
C₂₀H₂₃O₂ Compd., m. 185-8°, from tetra methylhematoxylone, 1508.
 Compd., m. 283°, from tetramethylhematoxylone, 1508.
C₂₀H₂₃IN₂ Isopyrazole, 4,4 - diethyl - 3,5 - diphenyl -, methiodide, 47011.
C₂₀H₂₃NO Chalcone, 2' - isopropyl - 4' - methoxy - 5' - methyl -, oxime, 11239.
p - Cinnamotoluide, *p* - butoxy -, 13969.
 1 - Piperidinol, 1 - phenethyl -, benzoate, - *HCl*, 19028.
C₂₀H₂₃NO₂ Aporphine, 3,4,5 - trimethoxy -, 47049.
 Cinnamaniside, *p* - butoxy -, 13968.
 Cyclopentanecetic acid, 1 - [α - 12 - naphthylcarbanylmethyl] -, 110.
 Hydrocotarane, xylol, 13688.
C₂₀H₂₃NO₂ Codeinone, acetyl dihydro -, and *HCl*, P 54747.
C₂₀H₂₃NO₃ Dnicotine acid, 4 - anisyl - 2,6 - dimethyl -, di-Et ester, 34719, 34720.
C₂₀H₂₃N₂O₂ Alanine, β - phenyl - *N* - (β - phenylalanylglycyl) -, 29929.
C₂₀H₂₃ Bihenzyl, cyclohexyl -, 49368.
 Metham, (methylcyclohexyl)diphenyl, 4937.
C₂₀H₂₃Br₂N₂O Fructose, (*p* - bromophenyl) methylsaccharone 11007.
C₂₀H₂₃Br₂N₂O Quinine, perlatomide, *HBr*, 5187.
C₂₀H₂₃INO Apomorphine, dimethyl -, methiodide, 2978.
 Desoxydehydropi-tephamine, methiodide, 2978.
C₂₀H₂₃INO Thebazine, methiodide, 16439.
 Thebazine acid, des - *N* - methyl -, methiodide, 16439.
C₂₀H₂₃N Acetophenone, *p* - cyclohexyl -, phenylhydrazono, 29476.
C₂₀H₂₃N₂O (See also *Quindine*, *Quinine*)
 1 - Piperidinol, 1 - phenethyl -, *p* - aminobenzoate, *HCl*, 19028.
C₂₀H₂₃N₂O Volnubiac acid, P 49511.
C₂₀H₂₃N₂O₂ *p, p'* - Bicarbamic acid, *m, m'* - dimethylthio -, di-Et ester, 29539.
C₂₀H₂₃N₂O₂ *p* - Oxidophenetic, 2,2' - dimethyl -, 1888.
C₂₀H₂₃N₂O Homocitramide, *N* - (dimethoxyphenethyl)nitro -, 1479, 34738.
C₂₀H₂₃N₂O₂ Monomethyl ester of acid from Hansen's acid, - *HNO₂*, 33879.
C₂₀H₂₃N₂O₂ Cargene, 2,4,6 - trinitro - *m* - cresol deriv., 1223.
C₂₀H₂₃N₂O₂ Piperonyl alcohol, α - (α - dimethylaminoethyl) -, picrate, 21629.
C₂₀H₂₃O Anisole, cyclohexylidenelab., 46899.
 Compd., m. 82-3°, from acetone and *m* - cresol, P 11407.
 Cresol, cyclohexylidenetriss., 1729, 12540.
 Cyclohexane, 1,3 - bis(benzoyloxy) -, 46777.
 Dimethyl ether, m. 115°, of compd. m. 181°, 4689.
 Δ^1 - 1 - Propenol, 1 - (6 - methoxythymyl) 3 phenyl -, 11239.
 α - Toluic acid, α, α - bis(γ - dimethylbutyl) -, 18033.
C₂₀H₂₃O₂S Borneol, naphthalenesulfonate 121.
 Naphthalenesulfonic acid, bornyl ester, 128.
C₂₀H₂₃O₂ Propiophenone, *p* - ethoxy - β - (3 - methoxy - *p* - phenethyl) -, 1256.
C₂₀H₂₃O₂ Propiophenone, 4 - ethoxy - 2 - hydroxy - β - (*p* - phenethyl) -, 1256.
C₂₀H₂₃O₂ Obivil, 51888.
C₂₀H₂₃O₂ Nodakem, 24454, 47083.
C₂₀H₂₃O₂ Glucoside, tetraacetylphenyl -, 1887.

- C₂₀H₂₄O₁₁ Galactoside, *O* - tetraacetyl - β - *p* - hydroxyphenyl-, 5167^a.
- C₂₀H₂₄BrN₂O₄ 4 - Isopyrrolepropionic acid, 2 - [5 - bromo - 3 - (β - carboxyethyl) - 4 - ethyl - 2 - pyrrolmethylene] - 3 - ethyl - 5 - methyl -, *HBr*, 1133^a.
- C₂₀H₂₄NO Ethanol, 2 - cyclohexylamino - 1,2 - diphenyl -, and *HCl*, 4462^a.
- C₂₀H₂₄NO₂ Base, from methiodide of the Me ether of *d*-beberine, and *HCl*, 147^a.
- C₂₀H₂₄NO₄ (See also *Laudanine*.) Sinomenine, methyl-, 5272^a; and *HCl*, 3700^a.
- C₂₀H₂₄NO₄ Dinicotinic acid, 4 - anisyl - 1,4 - dihydro - 2,6 - dimethyl -, di-Et ester, 3471^a, 3472^a.
- C₂₀H₂₄N₂O Semicarbazide, 1 - (β - 3 - methyl-cyclohexylphenyl) - 4 - phenyl-, 4090^a.
- C₂₀H₂₄N₂O₂S Glycine, *N* - [N - (N - 2 - naphthylsulfonyl)alanylvalyl]-, 1112^a.
Glycine, *N* - [N - [N - (2 - naphthylsulfonyl)leucyl]glycyl]-, 2992^a, 4192^a.
- C₂₀H₂₄N₂S Semicarbazide, 1 - (β - 3 - methyl-cyclohexylphenyl) - 4 - phenylthio -, 4690^a.
- C₂₀H₂₄N₂O₄ Semicarbazone of acid from Hansen's acid, and its *HCl*, 1387^a.
- C₂₀H₂₄ Bibenzyl, β , β' , α , α' , α' - hexamethyl-, 5169^a.
- C₂₀H₂₄As₂N₂O₂ Acetanilide, 5,5' - arsenobis-[2 - hydroxy - 3 - β - hydroxyethylamino - 842^a.
- C₂₀H₂₄Cl₂N₂O₂Pt₂, 1581^a, 1582^a.
- C₂₀H₂₄INO₂ Desoxythebaizone, dihydromethiodide, 1643^a.
Desoxythebaizonic acid, des - *N* - methyl dihydro-, methiodide, 1643^a.
Sinomenine, methiodide, 3700^a.
- C₂₀H₂₄INO₂ Isodihydrothebaizone, methiodide, 1644^a.
Thebaizone, dihydro-, methiodide, 1643^a.
- C₂₀H₂₄N₂ Aniline, β , β' - cyclohexyldienebis - [N-methyl-, and *HCl*, 4687^a.
Aniline, *N*, *N* - dimethyl - β , β' - cyclohexyldienebis-, and *HCl*, 4688^a.
Compd. from cyclohexanone and pyrrole, compds. with tin tetrahalides, 2963^a.
- C₂₀H₂₄N₂O₂ Cinchoninamide, 2 - cyclohexyloxy - *N*, *N* - diethyl-, 1217^a.
- C₂₀H₂₄N₂O₄ 4 - Isopyrrolepropionic acid, 2 - [3 - (β - carbomethoxyethyl) - 4,5 - dimethyl - 2 - pyrrolmethylene] - 3,5 - dimethyl -, *HBr*, 4226^a.
- C₂₀H₂₄N₂O₂S Norvaline, *N* - [α - (2 - naphthylsulfonylamidovaleryl)-, 2993^a.
Valine, *N* - [N - (2 - naphthylsulfonyl)-valyl]-, 2993^a.
- C₂₀H₂₄N₂O₂ Methylbetaine of compd. from Hansen's acid, and salts, 1387^a.
- C₂₀H₂₄N₂O₂ Sinomenine, semicarbazone, 3700^a.
- C₂₀H₂₄O₂ Naphthalenesulfonic acid, methyl ester, 128^a.
- C₂₀H₂₄O₂S Disulfide, bis(2 - ethoxy - 4,5 - dimethoxyphenyl), 3467^a.
- C₂₀H₂₄O₂ Glucose, monoacetone - 3 - benzyl -, diacetates, 107^a.
- C₂₀H₂₄O₂ Glucose, 3 - β - toluenesulfonyl - 5,6 - diacetylmonoacetone-, 103^a.
- C₂₀H₂₄O₂ Glucoside, 3 - β - toluenesulfonyl-triacetyl - β - methyl-, 103^a.
Glucoside 6 - β - toluenesulfonate, triacetyl - α -methyl-, 104^a.
- C₂₀H₂₄BrN₂ Δ^1 - 2 - Butenone, 4 - (2,3,4,6 - tetramethyl - Δ^1 - cyclohexenyl) -, β - bromophenylhydrazine, 3692^a.
- C₂₀H₂₄ClN₂O Cinchoninamide, 2 - chloro *N*, *N* - diisoamyl-, P 1217^a.
- C₂₀H₂₄NO₂ Diversine, 5272^a.
- C₂₀H₂₄NO₁₁ + 3H₂O See *Amygdalin*.
- C₂₀H₂₄BrNO₂ Bis(β - methoxy - α - methylbenzyl)dimethylammonium bromide, 3451^a.
- C₂₀H₂₄HgN₂ Aniline, β , β' - mercuribis[N, N - diethyl-, 1880^a.
- C₂₀H₂₄INO₂ Isodihydrosinomenine, methiodide, 3710^a.
- C₂₀H₂₄N₂ Aniline, β , β' - butylidenebis[N, N - dimethyl-, 4689^a.
Aniline, β , β' - α - methylpropylidenebis - [N, N - dimethyl-, 4689^a.
Dideoxyephedrine, and chloroplatinate 3453^a.
Indole, 3,3' - ethylidenebis[4,5,6,7 - tetrahydro - 2 - methyl - (?), 1635^a.
- C₂₀H₂₄N₂O₂ Glutamic acid, *N* - (N - benzoyl-leucyl)-, di-Me ester, 603^a.
Norpseudoephedrine, oxalate, 1472^a.
- C₂₀H₂₄N₂O₄ 4 - Homoprocatechol, α - ethyl-amino-, oxalate, 5169^a.
- C₂₀H₂₄N₂O₂ Sinomenine, dihydro-, semicarbazone, 3700^a.
- C₂₀H₂₄O₂ Undecanaphthenol, cinnamate, 496^a.
- C₂₀H₂₄O₂ Diacetate, bp 230-4°, of compd. 235-40°, 4690^a.
- C₂₀H₂₄O₂ Isovalerin, α , γ -di-, salicylate, 468^a.
- C₂₀H₂₄O₁₁ Glucoside, glucosidobenzal - methyl-, 108^a.
- C₂₀H₂₄O₁₁ Glucoside, phloracetophenone-rhamno-, 3475^a.
- C₂₀H₂₄Pb Plumbane, dibutylidiphenyl-, 4201^a.
Plumbane, di-*sec* - butylidiphenyl-, 4201^a.
--, di-*tert* - butylidiphenyl-, 4201^a.
--, diisobutylidiphenyl-, 4201^a.
- C₂₀H₂₄Sn Stannane, dibenzylbutylviethyl-, 118^a.
- C₂₀H₂₄NO Acetanilide, α , α' - dicyclohexyl-, 113^a.
- C₂₀H₂₄NO₂ Nipectic acid, 1 - amyl - 4 - hydroxy-Et ester, benzoate, *HCl*, P 477^a.
Nipectic acid, 4 - hydroxy - 1 - isoamyl-, Et ester, benzoate, *HCl*, P 477^a.
- C₂₀H₂₄N₂O Quinoline, (pentamethylphenyl-amino)-methoxy -, and *HCl*, P 628^a.
- C₂₀H₂₄N₂O₂ Cinchoninamide, 2 - (diethylaminoethoxy) - *N*, *N* - diethyl-, P 1217^a.
- C₂₀H₂₄ Benzene, bis(methylcyclohexyl)-, 493^a.
 β -Xylene, dicyclohexyl-, 4936^a.
- C₂₀H₂₄CuN₂As₂, 4420^a.
- C₂₀H₂₄HgI₂Te₂, 2113^a.
- C₂₀H₂₄INO₂ Des - *N* - methyldeoxythebaizone sinomenine, methiodide, 3700^a.
- C₂₀H₂₄N₂O₂ β , β' - (*s* - Dihydroxyethylidenebis[trimethylphenylammonium iodide]-, 121^a.
- C₂₀H₂₄N₂O₂ Nipectic acid, 4 - hydroxy - 1 - isoamyl-, Et ester, β - amidebenzoate, di-*HCl*, P 477^a.
- C₂₀H₂₄O₂ (See also *Abietic acid*.)
Pimaric acid, 3475^a, 4707^a, and salts, 4234^a.
Pyroabietic acid, 8205^a.
- C₂₀H₂₄O₂ Δ^1 - 3 - Dodecenone, 1 - 4 - dimethoxyphenyl-, 110^a.
- C₂₀H₂₄O₂ Agathidicarbonylic acid, 3711^a.
- C₂₀H₂₄O₂ Hydronarrosene B, 5010^a.
- C₂₀H₂₄O₂ Phthalic acid, bis(ethoxy - methyl-ester, P 2137^a.
- C₂₀H₂₄NO₂ Procatechuyl alcohol, α - α' -

- C₂₁H₁₄N₂O₃ Anthraquinone, aminobenzamido, P 993⁵.
- C₂₁H₁₄N₂O₄ Anthraquinone, aminobenzamido hydroxy-, P 3104⁴.
- 2 - Indolecarboxylic acid, 3 - (o - nitrophenyl) - 1 - phenyl -, 4699⁶.
- C₂₁H₁₄N₂O₂ 2 - Phenanthrothiazinone, phenylhydrazone, 139⁹.
- C₂₁H₁₄N₂O₅ Hydrazine, β - benzoyl - α, α - bis(p - thiocyanophenyl) -, 2245².
- C₂₁H₁₄N₂O₄ 4 - o - Tolylenediamide, N, N' - bis(2,4 - dinitrobenzyl) -, 4682⁹.
- C₂₁H₁₄O β, β' - Dibenzoxanthene(?), 3449⁹.
Indone, 2,3 - diphenyl -, 2476⁵, 2966³.
1-Naphthyl ketone, 1633³.
- C₂₁H₁₄O₂ Spiro[1,2 - benzopyran - 2,3' - 4,3 - β -naphthopyran], 3705⁹.
- C₂₁H₁₄O₄ 1(2) - Benzofuranone, 2 - (p - hydroxyphenyl) -, benzoate, 832⁹.
- C₂₁H₁₄O₆ 7 - meso - Benzanthreneone, 8,9 - dihydroxy -, diacetate, 2435⁹.
Phenolphthalein, 3' - formyl -, 2963⁴.
- C₂₁H₁₄BrN₂O₂ Anthraquinone, 1 - amino - 2 - bromo - 4 - p - toluino -, P 5194⁷.
- C₂₁H₁₄BrO 1 - Indanone, 2 - bromo - 3,3 - diphenyl -, 2176¹.
- C₂₁H₁₄Cl Anthracene, benzylchloro-, 1408^{1,2}.
- C₂₁H₁₄ClN₂O 4,5 - Pyrazolodione, 3 - (chlorophenyl) - 1 - phenyl -, 4 - phenylhydrazone, 3218⁹.
- C₂₁H₁₄ClN₂O₁₁ Benzoic acid, m - (5 - chlorovanillalamino) -, picrate, 4456⁴.
- C₂₁H₁₄ClO 9 - Anthracenecarbinol, 4 - chloro - α -phenyl -, 1408¹.
9 - Anthrol, 10 - benzal - 4 - chloro - 9,10 - dihydro-, 1408¹.
- C₂₁H₁₄Cl₂N₂O Hydrazine, α - p - chlorobenzoyl - β - N - p - chlorobenzoylanthranoyl -, 836².
- C₂₁H₁₄Cl₂O 9 - Anthrol, 9 - benzyl - 1,5,10 - trichloro - 9 α - dihydro -, 3222⁷.
- C₂₁H₁₄NO₂ 1,2 - Indandione, 3,3 - diphenyl -, monoxime, 2176¹.
3,4 - Phenanthrenequinone, 1 - p - toluino -, 1899⁴.
- C₂₁H₁₄NO₂ 1,3 - Dioxole, 1 - (p - nitrophenyl) - 4,5 - diphenyl -, 3919⁴.
- C₂₁H₁₄N₂O₂ Pyrazole, 3 - (nitrophenyl) - 1,5 - diphenyl -, 3469⁷, 3470¹.
1,3,4 - Triazole - 1 - o - benzoic acid, 2,5 - diphenyl -, 835⁹.
- C₂₁H₁₄N₂O₂ 1,2,4 - Triazol - 5(4) - one, 3 - (3,4 - methylenedioxyphenyl) - 1,4 - diphenyl -, 3683⁷.
- C₂₁H₁₄N₂O₄ Ether, methyl 1 - phenanthryl, picrate, 4468⁷.
- C₂₁H₁₄N₂O₃ 3,4 - Phenanthro - 7 - keto - 1,2,5,6 - heptaotriazine, phenylhydrazone, 140⁵.
- C₂₁H₁₄N₂O₄ Tetryl, compd. with phenanthrene, 3214³.
- C₂₁H₁₄N₂O₅ 5 - Acetyl - 4,10 - dihydro - 10 - methyl - 4 - ketophenazonium picrate, 2717⁹.
- C₂₁H₁₄N₂O₇ 2(1) - s - Triazone, tetrahydro - 4 - imino - 6 - (nitrophenyl) -, dipicrate, 4220^{5,6}.
- C₂₁H₁₄ Indene, diphenyl-, 3205⁷.
Methane, bis(naphthylxy)-, 1768⁴.
Propine, 1,3,3-triphenyl-, 3696⁴.
- C₂₁H₁₄BrNO Acrylophenone, β - amino - p - bromo - α, β - diphenyl -, 142⁹.
- C₂₁H₁₄Br₂O₃ Bromocresol purple, 2871⁷.
- C₂₁H₁₄ClN₂O₂ Hydrazine, α - N - benzoyl anthranoyl β - p - chlorobenzoyl -, 836¹.
- Hydrazine, α - benzoyl - β - N - p - chlorobenzoylanthranoyl-, 836¹.
- C₂₁H₁₆Cl₂O₂ 9,10 - Anthradiol, 9 - benzyl - 1,5 - dichloro - 9,10 - dihydro -, 3222⁹.
- C₂₁H₁₆HgO₄ Aurin, acetoxymercuri-, 4943⁶.
- C₂₁H₁₆MoN₂O₅, 2899².
- C₂₁H₁₆N₂O 7,8 - Acenaphthoxazole, 8 - (p - dimethylaminophenyl)-, 2964⁹.
2 - Naphthamide, 3 - amino - N - 2 - naphthyl-, 3909⁶.
- C₂₁H₁₆N₂O₂ Anthraquinone, 1 - amino - 4 - p - toluino-, 1273¹.
1,3,4,6 - Oxidiazin - 5(4) - one, triphenyl -, 1903⁴, 2977⁴.
- C₂₁H₁₆N₂O₂ Benzanilide, o' - (phenyloxamyl) -, 4468⁸.
- C₂₁H₁₆N₂O₆ Phenolphthalein, 3' - formyl -, dioxime, 2963⁴.
- C₂₁H₁₆N₂O₆ Phthalimide, N, N' - [(hydroxymethyl)ethylene]bis - (?), acetate, 2152⁹.
Phthalimide, N, N' - (2 - hydroxytrimethylene)bis - (?), acetate, 2152⁴.
- C₂₁H₁₆N₂O₅ 3,6 - Coumarindisulfonanilide, 127¹.
- C₂₁H₁₆N₂O₂ Benzoic acid, (p - nitrobenzyloxy) -, p - nitrobenzyl ester, 3454⁴.
- C₂₁H₁₆N₂O₃ Benzoic acid, (p - nitrobenzyl sulfonyl) -, p -nitrobenzyl ester, 827⁹.
- C₂₁H₁₆N₂O₇ 1,3,4 - Triazole, 2 - methyl - 1,5 - diphenyl-, picrate, 836¹.
- C₂₁H₁₆O Carbinol, di-1-naphthyl-, 1633¹.
Fluorene, 9-anisal-, 3917⁵.
1-Indanone, diphenyl -, 2176^{1,6}.
- C₂₁H₁₆O Compd, m 129.30⁷, from 2,3 - diphenyl - 1 - indanone and H₂O, 2176¹.
- C₂₁H₁₆O₃ 1,2 - Benzanthren - 7 - ol, 5 - methoxy -, acetate, 5472².
- C₂₁H₁₆O₄ Phenolphthalein, 2'-methyl -, 2120¹.
- C₂₁H₁₆O₄ Ketone, dihydroxyphenyl 1 - naphthyl, diacetate, 2435⁹.
- C₂₁H₁₆O₄ Glycolic acid, (p - hydroxyphenyl - salicyl-, benzoate, 832⁹.
 Δ^1 - 3,5 - Heptadienedione, 1,7 - bis(3,4 - methylenedioxyphenyl) -, 4211⁷.
- C₂₁H₁₆O₄ Anthrapurpurin, 6 - methyl - 2 - triacetate, 3464⁴.
Anthraquinone, trihydroxymethyl, triacetate, 3464⁴.
Flavopurpurin, 7 - methyl - (?), triacetate, 3464⁴.
- C₂₁H₁₆O₅ 3 - Isoxanthene - 9 - o - benzenesulfonic acid, hydroxy - 3 - ketodimethoxy -, 2964³.
- C₂₁H₁₆AsN₂O₂ Benzenearsonic acid, p - 3 - amino - 2 - phenyl - 4 - quinolyazo -, and Na salt, 839².
- C₂₁H₁₆ClN₂O₂ Hydrazine, β - benzoyl - α - chloro - α - toluyl) - α - phenyl -, 190¹.
- C₂₁H₁₆ClN₂O₂ Toluidine, N-(5 chlorovanillal) -, picrate, 4456⁴.
- C₂₁H₁₆ClN₂O₁₀ p - Anisidine, N - (5 - chlorovanillal) -, picrate, 4456⁴.
- C₂₁H₁₆ClO 9 - Anthrol, 9 - benzyl - 1 - chloro - 9,10-dihydro-, 1408¹.
- C₂₁H₁₆N 2 - Naphthylamine, N - (ϵ - phenyl $\Delta^{1,4}$ - pentadienyldene) -, 3688¹.
Skatole, 1,2-diphenyl-, 4699⁶.
- C₂₁H₁₆NO 5(10) - Acridone, 1 - methyl - 10 - tolyl-, 839⁹.
- Acrylophenone, β - amino - α, β - diphenyl -, 142⁹.
1 - Indanone, 3,3 - diphenyl -, oxime, 2176¹.

- C₁₁H₇NO₃** Pyridine, 2,6 - diphenacyl -, and salts, 4704⁸.
- C₁₁H₇NO₃S** Benzanilide, *o*' - mercapto - *N* - methyl-, benzoate, 142⁸.
- Thioxanthone**, 4 - methoxy - 1 - *p* - tolueno-, 3706².
- C₁₁H₇NO₃** Anthranilic acid, *N* - (5 - benzoyl - *o*-tolyl)-, 839⁸.
- Ethylene oxide**, α - benzohydril - β - (*p* - nitrophenyl)-, 3919⁸.
- C₁₁H₇NO₃S** 4 - Phenanthrenesulfonic acid, 1,2 - diketo-, *p* - toluidine salt, 3466².
- C₁₁H₇NO₃** 3,5 - Benzofurandiol, 2 - *p* - anisyl - 1,2 - dihydro - 1 - imino - 2 - (2,4,6 - trihydroxyphenyl)-, 4691⁸.
- C₁₁H₇N₂O** 2 - Naphthamide, 3 - hydrazino - *N* - 2 - naphthyl-, - *HCl*, 3909⁸.
- C₁₁H₇N₂O₂** 2 - Naphthanilic acid, 3 - (4,5 - dihydro - 5 - keto - 3 - methyl - 1 - pyrazolyl)-, 3909⁸.
- C₁₁H₇N₂O₂** 2 - Naphthanilide, (4,5 - dihydro - 5 - keto - 3 - methyl - 1 - pyrazolyl) - 3-hydroxy-, 3909⁸.
- Piperonal**, 2,4 - diphenylsemicarbazone, 3682².
- C₁₁H₇N₂O₂** Pyruvic acid, (*o* - nitrophenyl) -, β , β - diphenylhydrazone, 4698⁸.
- C₁₁H₇N₂O** 1,2,4 - Triazole, 5 - anilino - 3 - benzamido - 1 - phenyl-, 2177³.
- C₁₁H₇N₂O₂** Acridine, 5 - amino - 2,8 - dimethoxy-, picrate, 1904¹.
- C₁₁H₇** Propene, 1,1,2-triphenyl-, 3908¹.
- C₁₁H₇Br₂N₂** Amarine, perbromide, - *HBr*, 389².
- C₁₁H₇Br₂O₂Se** Tris(bromocresyl)selenonium bromide, 2159⁸.
- C₁₁H₇Cl₂O₂** Methane, bis(5 - chloro - *o* - anisyl)-phenyl-, 1129¹.
- C₁₁H₇Cl₂O₂** Carbinol, bis(5 - chloro - *o* - anisyl)-phenyl-, 1129¹.
- C₁₁H₇N₂O** *p* - Phenylenediamine, *N* - 9 - fluorenylidene - *N'*, *N'* - dimethyl -, *N* - oxide, 3919⁸.
- C₁₁H₇N₂O₂** Benzamide, *N* - methyl - *N*, *N'* - *p*-phenylenebis-, 4700¹.
- Naphthalimide**, *N* - (*N* - propylanilino) -, 4214¹.
- Pyruvic acid**, diphenyl-, phenylhydrazone, 1617¹.
- C₁₁H₇N₂O₄** Glyoxylic acid, (*o* - benzamido-phenyl)-, PhNH₂ salt, 4469⁸.
- 2 - Indolecarboxylic acid**, 3 - (β - phthalimidoethyl)-, Et ester, 834¹.
- C₁₁H₇N₂S** 1,2,4 - Triazole, 5 - anilino - 1 - phenyl - 3 - (β - phenylthiocarbamido) -, 2177³.
- C₁₁H₇O** Benzohydril, *o* - styryl - (*p*), 2179⁸.
- Isochroman**, 1,3-diphenyl-, 2178¹.
- Stilbene**, α -*p*-anisyl-, 1704¹.
- C₁₁H₇O₂** Acetophenone, α - *p* - anisyl - α - phenyl-, 4687⁴.
- Ethanol**, 1,2 - diphenyl-, benzoate, 2179⁸.
- 9 - Fluorene-carbinol**, 9 - methoxy - α - phenyl-, 3919⁸.
- Propionic acid**, β -triphenyl-, 2176¹.
- C₁₁H₇O₃** Quinone, 2 - methoxy - 5 - α - methyl benzohydril-, 4682⁴.
- C₁₁H₇O₃** Malonic acid, benzylnaphthylmethyl -, 2707^{1,3}.
- C₁₁H₇O₃S** Cresol red, 2901⁸.
- C₁₁H₇O₃** Quinone, 2,5 - di - *p* - anisyl - 3 - hydroxy - 6 - methoxy -, 1127⁸.
- Rotenone**, 601¹.
- C₁₁H₇O₃S** Cotoin, *p* - toluenesulfonate, 830⁸.
- Isocotoin**, *p* - toluenesulfonate, 830⁸.
- C₁₁H₇O₃** 1,2,9 - Anthracenetriol, 1,9 - diacetate, 2 - ethylcarbonate, 4698¹.
- Flavanone**, 5,7 - dihydroxy -, triacetyl deriv., 836⁸.
- $\Delta^2(5)\alpha$ - Furanacetic acid**, α ,4 - di - *p* - anisyl - 5 - keto - 3 - methoxy -, 1128¹.
- Pulvic acid**, *p*, *p'* - dimethoxy -, Me ester, 1128¹.
- C₁₁H₇O₃** 2(1) - Benzofuranone, 1 - benzal - 5,6 - dihydroxy -, bis(ethylcarbonate), 4698².
- Coumarin**, 3 - (3,4 - dimethoxyphenyl) - 5,7 - dihydroxy -, diacetate, 4681⁸.
- C₁₁H₇O₃** Xanthopurpurin, 2 - methoxy -, bis(ethylcarbonate), 4697².
- C₁₁H₇O₃S** Benzenesulfonic acid, *o* - (2,4,5 - trihydroxybenzoyl) -, tetraacetate, 2961⁴.
- C₁₁H₇Br₂NO** Piperidine, 2,6 - dibromo - 2,6 - bis(α - bromophenacyl) -, 4706⁸.
- C₁₁H₇Cl₂IN₂S** 5 - Chloro - 1 - (1 - (5 - chloro - 2,3 - dimethyl - 1(2) - benzothiazylidene)propenyl) - 2,3 - dimethylbenzothiazolum iodide, 3911.
- C₁₁H₇INO** Thyroxine, *N* - acetylacetyl -, Me ester, 1632¹.
- C₁₁H₇NO** Anthranilic acid, *N*, *N'* - di - *o* - tolyl-, 839⁸.
- Anthrol**, tetrahydro -, carbanilate, 4694⁷.
- Ethanol**, 1,2 - diphenyl-, carbanilate, 2179⁸.
- Piperidine**, 2,6 - diphenacylidene -, 4706².
- C₁₁H₇NO₃S** Phenanthrenesulfonic acid, *p* - toluidine salt, 1468⁸.
- 2 - Propanone**, 1,3 - diphenyl -, oxime, benzenesulfonate, 1895².
- C₁₁H₇NO₃S** Phenanthrenesulfonic acid, dihydroxy-, *p* - toluidine salt, 1899¹, 3466².
- C₁₁H₇N₂O** Glycine, *N* - phenyl -, β - benzal - α phenylhydrazide, 145¹.
- 1,2 - Propanedione**, 1,3 - diphenyl -, 1 - oxime, 2 - phenylhydrazone, 4699⁸.
- C₁₁H₇N₂O₂** Hydrazine, β - benzoyl - α - phenyl - α - *N* - phenylglycyl -, 145¹.
- C₁₁H₇N₂O** Nicotinic acid, 2 - [(aminotolyl)tolyl] carbamyl-, 137¹.
- C₁₁H₇N₂O₂S** Pseudourea, α , γ - dimethyl - α , β - diphenylthio -, picrate, 1154¹.
- C₁₁H₇Propane**, 1,1,3 - triphenyl -, 3696⁸.
- C₁₁H₇ClNO₂** 2 - Naphthoic acid, 4 - (α - chloro - ϕ - dimethylaminobenzyl) - 3 - hydroxy - Me ester, - *HCl*, 3220⁸.
- C₁₁H₇ClO₂P** Phosphine, chloroethoxy(triphenyl methoxy)-(*p*), 3921¹.
- Phosphine oxide**, chloroethoxy(triphenyl methyl)-(*p*), 3921¹.
- C₁₁H₇N₂** Propiophenone, β , β - diphenylhydrazone, 4699⁸.
- C₁₁H₇N₂O** 2 - Propanone, 1 - phenoxy - 3 - phenyl -, phenylhydrazone, 4481¹.
- C₁₁H₇N₂O** Benzoic acid, β , β - di - *p* - anisyl hydrazide, 4938⁸.
- C₁₁H₇N₂O₄** Fumaric acid, 5 - anilino - 1 - phenyl imino - $\Delta^2(4)$ - 2 - pentadienol salt, 2438¹.
- C₁₁H₇N₂O₃S** Alanine, *N* - (*N* - 2 - methylsulfonylglycyl) - β - phenyl -, 1112¹.
- C₁₁H₇N₂S** Urea, α - phenyl - β - (1,2,3,4 - tetrahydro - 2 - anthryl)thio -, 4695².
- C₁₁H₇N₆** Compd., m. 161⁸, from glycerosol and PhNHNH₂, 819⁸.
- C₁₁H₇O** Ethanol, 2 - [α - (α - hydroxybenzyl)phenyl] - 1 - phenyl -, 2178¹.
- 1,2 - Propanediol**, 1,2,3 - triphenyl -, 2172¹.
- C₁₁H₇O₃** 1,2 - Ethanediol, 1 - *p* - anisyl - 1,3 - diphenyl -, 4687^{1,3}.

- C₂₁H₃₀O₄ 1,3,7,9 - Nonanetetrone, 1,9 - diphenyl-, 4706^a.
- C₂₁H₃₀O₇ γ - Pentenic acid, α - acetyl - δ - (4 - hydroxy - 1 - naphthyl) - β - keto -, Et ester, methylcarbonate, 4211^b.
- Phloropropiophenone, β - phenyl -, triacetate, 837¹.
- C₂₁H₃₀O₈ Phloretin, triacetyl-, 1645^b.
- C₂₁H₃₀O₉ Meconin, 2 - (2,5 - dihydroxy - *p* - anisyl)-, diacetate, 4682^a.
- C₂₁H₃₀O₁₁ See *Asterin*; *Chysanthemin*.
- C₂₁H₃₁BrN₂O₂ Strychnine, bromo -, dibromide, 5187^a.
- C₂₁H₃₁ClN₂ *p* - Benzenimine, 4 - [(*p* - aminophenyl)phenylmethyl]enyl-, methochloride, 384¹.
- C₂₁H₃₁ClN₂O₃ 4 - Methoxy - 1 - [1 - (4 - methoxy - 2 - methyl - 1(2) - benzothiazylidene)propenyl] - 2 - methylbenzothiazolium perchlorate, 391¹.
- C₂₁H₃₁ClO₃Se Trianisylselenonium chloride, *Hg Cl₂ compd.*, 2159^a.
- Tricresylselenonium chloride, 2159^a.
- C₂₁H₃₁ClSi₃ Silicane, chlorotri - *p* - tolyl -, 2430^a.
- C₂₁H₃₁ClSi₃Stannane, chlorotri - *m* - tolyl -, 118⁷.
- C₂₁H₃₁Cl₂HgO₃Se Trianisylselenonium chloride, *HgCl₂ compd.*, 2159^a.
- C₂₁H₃₁CoN₂O₂ Ketone, methyl pyridyl, oxime, Co deriv., 4702^a.
- C₂₁H₃₁IN₂Se 2 - Ethyl - 1 - [1 - (2 - ethyl - 1(2) - benzoselenazylidene)propenyl] - benzoselenazolum iodide, 142^a.
- C₂₁H₃₁ISn Stannane, tribenzylido -, 118⁷.
- C₂₁H₃₁NO₂ Carbinol, (*p*-dimethylaminophenyl)-(*p* - hydroxyphenyl)phenyl -, 354¹.
- Compd., m. 125^o, from 2,6 - diphenacylidene piperidine, 4706^a.
- Ethanol, 2 - amino - 1 - *p* - anisyl - 1,2 - diphenyl-, 4693^a.
- α , γ , ϵ - Heptatrieno - *p* - phenetide, ξ - phenyl-, 3689¹.
- C₂₁H₃₁NO₃ Carbinol, (*p* - dimethylaminophenyl)-bis(*p* - hydroxyphenyl) -, 384⁷.
- Cinnamic acid, *p* - (*p* - benzoylcinnamal-amino)-, Et ester, 3911^a.
- 2(3) - α - Naphthazalone, 3a,4,5,9b - tetrahydro - 3a - hydroxy - 9b - methyl - 1 - phenyl -, acetate, 3693^a.
- C₂₁H₃₁NO₄ 2 - Naphthoic acid, 4 - (*p* - dimethylamino - α - hydroxybenzyl) - 3 - hydroxy -, Me ester, and *HCl*, 3221^a.
- C₂₁H₃₁NO₅ (See also *Hydrastine*)
- Butyric acid, β - cyano - δ - hydroxy - γ - (*m* - methoxyphenoxy)-, benzoate, 4481^a.
- C₂₁H₃₁NO₆Se Tri - 4,3 - cresylselenonium nitrate, 2159^a.
- C₂₁H₃₁NO₇ Hydrastine, amine oxide, and *HCl*, 4224^a.
- C₂₁H₃₁N₂O₃ Thiazole, 2 - amino - 5 - (amino-tolyl) - 4 - tolyl -, diacetyl deriv., 1410^a.
- C₂₁H₃₁NO₄ Valeric acid, α - keto - δ - phthalimido -, Et ester, phenylhydrazone, 834^a.
- C₂₁H₃₁N₂O₃ Barbituric acid, 5,5 - diethyl - 1 - *p* - nitrobenzyl - 3 - phenyl -, 821^a.
- Dehydrobrucinoic acid, 3230^a.
- C₂₁H₃₁N₂O₄ Acetophenone, *p* - (2 - ethoxy - 1 - naphthylazo)-, semicarbazone, 3461^a.
- C₂₁H₃₁O₆P Methanephosphonic acid, triphenyl-, di-Me ester, 3921^a.
- C₂₁H₃₁Stib Stibine, tribenzyl-, P 2187^a.
- C₂₁H₃₁BrN Piperidine, 1 - (bromomethyl-anthrylmethyl)-, 5183^a.
- C₂₁H₃₁BrNO₂ Heroine, bromo-, *HBr*, 5187^a.
- C₂₁H₃₁N₂O₂ (See also *Strychnine*)
- Carbinol, (*p* - aminophenyl)(*p* - hydroxyphenyl) -, 354¹.
- C₂₁H₃₁N₂O₃ α - Toluamidine, *N* - benzyl -, benzenesulfonate, 1895^a.
- C₂₁H₃₁N₂O₄ 3 - Hydantoinacetic acid, α ,5 - di-benzyl-, Et ester, 2165^a.
- C₂₁H₃₁N₂O₇ Tartaric acid, 5 - anilino - 1 - phenyl-imino - Δ^2 ,4 - 2 - pentadienol salt, 2438^a.
- C₂₁H₃₁N₂O₈ Malonic acid, bis(*m* - nitrobenzyl) -, di-Et ester, 5186^a.
- C₂₁H₃₁OSi₃ Silicol, tri-*p*-tolyl-, 2430^a.
- C₂₁H₃₁O₂ Phenol, cyclopentylidenebis -, diacetate, 4680^a.
- C₂₁H₃₁O₃ Acetate, m. 123-4^o, of compd. m. 133-4^o, 150^a.
- Derritol, 4472^a.
- Isoderritol, 4472^a.
- 9 - Phenanthrenecarboxylic acid, 8 - ethyl 2,3,5,6 - tetramethoxy -, 843^a.
- C₂₁H₃₁O₄ Flavone, 3,3',4',5,7,8 - hexamethoxy -, 2181^a.
- Glucoside, dibenzoyl β - methyl -, 2944^a.
- Isoflavone, 5 - hydroxy - 3',4',5',6',7 - pentamethoxy - 2 - methyl -, 2180^a.
- C₂₁H₃₁O₄ Carthamin, 1906¹, 3171¹.
- Isocarthamin, 1906¹.
- C₂₁H₃₁IN₂ 1,2 - Dibenzyl - 4,5,6,7 - tetrahydroindazolium iodide, 2972^a.
- C₂₁H₃₁N Piperidine, 1 - (2 - methyl - 9 - anthrylmethyl)-, 5183^a.
- C₂₁H₃₁NO 6 - Cyclohepta[*g*]quinoline, 5 - benzoyl - 5,5a,7,8,9,10,10a,11 - octahydro, 138^a.
- Quinoline, 4 - ethyl - 6 - isobutoxy - 2 - phenyl -, 2443^a.
- C₂₁H₃₁NO₂ 2 - Anthrol, 1,2,3,4,5,6,7,8 - octahydro-, carbanilate, 4693^a.
- Lobelainedine, 4706^a.
- Norlobelaine, and *HCl*, 4706^a.
- C₂₁H₃₁NO₂ Homotrilobine-methylmethine, 39^a.
- C₂₁H₃₁NO₂ See *Heroine*; *Homochelidonine*.
- C₂₁H₃₁NO₃ Acrylic acid, α - (2 - ethyl - 1 - dimethoxyphenyl) β - (4,5 - dimethoxy-2-nitrophenyl)-, 843^a.
- C₂₁H₃₁NO₄ Protocatechuy alcohol, α - (benzylaminomethyl) -, 3,4 - diacetate, oxalate, 5162^a.
- C₂₁H₃₁NO₅ α , γ , ϵ - Heptatrienaldehyde, ξ - dimethylaminophenyl -, phenylhydrazone, 381^a.
- C₂₁H₃₁NO Carbinol, bis(*p* - aminophenyl)-(*p* - dimethylaminophenyl) -, 354¹.
- C₂₁H₃₁NO₂ Benzyl alcohol, *o*,*o'* - azoxybis-compd. with *o* - hydroxylaminobenzyl alcohol, 2163^a.
- Homoveratrolitrile, 2 - nitro - α - (1,2,3,4 - tetrahydro - 6 - methoxy - 2 - methyl-1-isoquinolyl) -, 5177^a.
- C₂₁H₃₁NO₃ Homotrilobine, methiodide, 39^a.
- C₂₁H₃₁NO₃ Benzaldehyde, methyl(methylbenzylhexenylphenyl)hydrazones, 4690^a.
- C₂₁H₃₁NO₄ Strychnidine, 3710^a.
- C₂₁H₃₁N₂O₂ Strychnidine, hydroxyhydrazide, 3711^a.
- Strychnine, dihydro -, and salts, 3710^a, 3711^a.
- C₂₁H₃₁N₂O₄ Homopiperonyl alcohol, α - (1 - piperidylmethyl)-(?), picrate, 4683^a.

- 1 - Piperidineethanol, β - piperonyl(-), picrate, 4683¹.
- C₂₁H₃₃O₄ Glutaric acid, α, β - diphenyl, di-Et ester, 4930².
- α -Toluic acid, α -phenyl-, 2710⁴.
- C₂₁H₃₃O₁₀ + 2H₂O See *Phlorhizin*.
- C₂₁H₃₁ClN₂O₆ + 3H₂O 3,4 - Dihydro - 6,7 - dimethoxy - 2 - methyl - 1 - (2 - nitroveratryl)isoquinolinium chloride, 147³.
- C₂₁H₃₁N₂O₆ 3,4 - Dihydrodimethoxy - 2 - methyl - 1 - (nitroveratryl)isoquinolinium iodide, 147³, 3473².
- C₂₁H₃₁NO₂ Norlobeline, 4704⁸.
- C₂₁H₃₁NO₄ (See also *Morphine, ethyl* -)
Aporphine, tetramethoxy-, and *III*, 3173², 3474¹.
- Corybulbine, 3230⁴.
- Isocorybulbine, 3230⁴.
- 6,4 - *peri* - Naphthoquinoline, 5,6,6a,7-tetrahydro - 1,2,10,11 - tetramethoxy-6-methyl-, 148¹.
- Norcoralydine, 1644¹.
- C₂₁H₃₁NO₄ Acrylic acid, β -(2-amino-4,5-dimethoxyphenyl) - α - (2-ethyl-4,5-dimethoxyphenyl)-, 843¹.
- C₂₁H₃₁N₂O Camphor, 4 (1-naphthyl)semicarbazone, 601¹.
- Cyclohexanone, 2,6-dibenzyl-, semicarbazone, 2702⁴.
- C₂₁H₃₁N₂O₂ Acetanilide, α -(N-benzoylleucylamino)-, 2092².
- Codinal, dihydro-, phenylthiazone, *III*, 2979².
- C₂₁H₃₁N₂S Semicarbazide, 1-methyl-1-methylcyclohexenylphenyl- - 4 - phenylthio-, 4690².
- C₂₁H₃₅ Propane, 3-cyclohexyl-1,1-diphenyl-, 3600⁴.
- C₂₁H₃₅BrN₂O₄ 3 - Isopyrrolepropionic acid, α -(bromomethyl) - 2 - [(5-bromomethyl)-3-(β -carboxyethyl) - 4-ethyl-2-pyrrolylmethylene] - 4 - ethyl-, -*III*-, 1133².
- C₂₁H₃₅INO₂ Morphothebaine, dimethyl-, methiodide, 297².
- C₂₁H₃₅N₂O Strychnidine, dihydro-, and salt-, 3710^{2,7}.
- C₂₁H₃₅N₂O₂ Acetanilide, p, p' -isopropylidenebis-[N-methyl-, 4686².
- Pinelanilide, γ, γ -dimethyl-, 4673⁴.
- C₂₁H₃₅N₂O₃ (See also *Yohimbine* -)
Strychnic acid, dihydro-, and -*III*-, 3711².
- C₂₁H₃₅N₂O₄ Strychnic acid, dihydroxydihydro-, 3711².
- C₂₁H₃₅N₂O₅ Dimethyl ester, m 225-7², of acid from Hansen's acid, and -*HN*O₂, 1387².
- 3 Pyrrolepropionic acid, 2,2'-methylenebis[5-carboxy-4-ethyl-, 1133².
- C₂₁H₃₇O₂ Valeric acid, α -phenethyl & phenyl-, Et ester, 2934².
- C₂₁H₃₇O₂ Olivil, methyl-, 5188².
- C₂₁H₃₇O₁₁ Glucoside, tetraacetyl- β -benzyl-, 1881¹.
- C₂₁H₃₇O₁₁ Galactoside, O -tetraacetyl- β -*p*-anisyl-, 5167¹.
- C₂₁H₃₇N Norlobelan, salts, 4706⁸.
- C₂₁H₃₇NO₂ Norlobelamine, 4704⁸, and salt-, 4706⁸, 4707¹.
- C₂₁H₃₇NO₂ Laudanosine, 1883².
- C₂₁H₃₇N₂ Aniline, p, p' -cyclopentylidenebis[N,N-dimethyl-, and -*HCl*, 4683².
- Aniline, (3-methylcyclohexylidene)bis[N-methyl-, and -*HCl*, 4690².
- C₂₁H₃₇N₂O Urea, s -dicarboxyl-, 5470².
- C₂₁H₃₇N₂O See *Optichina*.
- C₂₁H₃₉N₂O₄ 3 - Isopyrrolepropionic acid, 2-methyl-2-pyrrolylmethylene- - 4-ethyl-1133².
- Isoquinoline, 1 - (aminoveratryl) - 1,2,3,4-tetrahydrodimethoxy - 2 - methyl-, 1181², 3473².
- C₂₁H₃₉N₂O₄ Glucose, 3,5,6-trimethyl-, phenyl-osazone, 4451¹.
- Sinomeine, methyl-, semicarbazone, 3709².
- C₂₁H₃₉O₂ 1,9-Nonandiol, 1,9-diphenyl-, 4706⁸.
- C₂₁H₃₉O₂ Duodephanthondiacid, 1515¹.
- C₂₁H₃₉N Anyllamine, N,N-dimethyl- β -phenethyl- α -phenyl-, 2935².
- C₂₁H₃₉NO₂ Galahleptonamide, heptaacetyl-, 2912².
- C₂₁H₃₉N₂O Carvone, 1-carvacylsemicarbazone, 5170².
- C₂₁H₃₉O₂ Acid, m 252-3², from isogitoxigenmic acid, 1196¹.
- C₂₁H₃₉O₂ Volcanitol, heptaacetate, 4192².
- C₂₁H₃₉NO₂ Heptamethoxycinnamyl, compd with guaiacol, 382².
- C₂₁H₃₉N₂O₂ Phenethylamine, α -(α, α -diethoxyethyl)- p -toluenesulfonate, 1895².
- C₂₁H₃₉NO₂ Protocatechyl alcohol, α -theptylaminomethyl-, 3,4-diacetate-, oxalate-, 5162².
- C₂₁H₃₉N₂O Camphor, 4-carvacylsemicarbazone, 5470².
- C₂₁H₃₉O₂ Δ^1 - 3 - Dodecenone, 1- p -cumenyl-, 116¹.
- C₂₁H₃₉O₂ Pimatic acid, Me ester, 1224².
- C₂₁H₃₉O₂ Ginkgollic acid, 382².
- C₂₁H₃₉AlO₂ 2,4 - Pentanedione, 3-ethyl-, Al deriv., P 606².
- C₂₁H₃₉CrO₂ 2,4 - Pentanedione, 3-ethyl-, Cr deriv., P 606².
- C₂₁H₃₉FeO₂ 2,4 - Heptanedione, Fe deriv., P 606².
- 2,4-Pentanedione, 3-ethyl-, Fe deriv., P 606².
- C₂₁H₃₉NO₂ Tridecone acid, p -hydroxy-, Me ester carbamate, 1388².
- C₂₁H₃₉N₂O + H₂O Hydrobiobol, dimro-, 382².
- C₂₁H₃₉O Ginkgol Me ether, 382².
- C₂₁H₃₉O₂ Biobol, 382².
- C₂₁H₃₉BrN₂O₄ Glutamic acid, N-[N-(N- α -bromopropionylvalyl)leucyl]glycyl-, 374².
- C₂₁H₃₉N₂O Cellamine, 473².
- C₂₁H₃₉N₂O Imidazole, 2,4,5-tricyclohexyl-1,4,5-dihydro-1-nitroso-, 3891².
- C₂₁H₃₉BrN₂ Imidazole, dihydro-2,4,5-tricyclohexyltetrahydro-, -*III*Br, 388².
- C₂₁H₃₉N₂ Imidazole, 2,4,5-tricyclohexyl-4,5-dihydro-, and salts, 388².
- C₂₁H₃₉N₂O Trisoxamylamine, picrate, 5088¹.
- C₂₁H₃₉O₂ Hydrobiobol, 382².
- C₂₁H₃₉O₂ Compd, m 98-8.5², from ginkgol Me ether, 382².
- C₂₁H₃₉N₂O₂ Glutamic acid, N-[N-(N-alanylvalyl)leucyl]leucyl-, 374².
- C₂₁H₃₉Cl₂O₂ Oleic acid, β, β' -dichloropropyl ester, 3913².
- C₂₁H₃₉N₂ Imidazole, 2,4,5-tricyclohexyltetrahydro-, and salts, 389².
- C₂₁H₃₉O₂ Eleostenic acid, isopropyl and Pr esters, 2151².
- C₂₁H₃₉O₂P Δ Glucoside, α -methyl-, tri-, 6-phosphate, 2912².
- C₂₁H₃₉Cl₂O₂ Stearic acid, β, β' -dichloroisopropyl ester, 3913².
- C₂₁H₃₉O Cycloheptacosanone, 1111¹.

- C₂₁H₄₀O₃ Acetoacetic acid, hexahydrofarnesyl-, Et ester, 3702⁸.
- C₂₁H₄₀O₄ Malonic acid, amylonyl-, di-Et ester, 2421⁷.
Malonic acid, butyldecyl-, di-Et ester, 2421⁷.
—, *sec*-butyldecyl-, di-Et ester, 2421⁸.
—, decylisobutyl-, di-Et ester, 2421⁸.
—, diheptyl-, di-Et ester, 2421⁷.
—, dodecylethyl-, di-Et ester, 2421⁷.
—, hendecylpropyl-, di-Et ester, 2421⁷.
—, hexyloctyl-, di-Et ester, 2421⁷.
—, methyltridecyl-, di-Et ester, 2421⁷.
Nonadecanoic acid, *o*-hydroxy-acetate, 3664⁷.
C₂₁H₄₁BrO₂ Heneicosanoic acid, *o*-bromo-, 3664⁷.
C₂₁H₄₁O₂ Heneicosanoic acid, 556².
C₂₁H₄₁O₂ *n*-Eicosanoic acid, *n*-hydroxy-, Me ester, 3664⁷.
Heneicosanoic acid, *n*-hydroxy-, 3664⁷.
C₂₁H₄₂O₁ Stearin, mono-, 1110⁷, 1870⁷.
C₂₁H₄₄ Heneicosane, 4438².
C₂₁H₄₁N₃S Tetraisoamylammonium thiocyanate, 5088¹.
C₂₇H₃₆Cl₂O₂ 3,9 - Perylenedicarbonyl chloride, 4212³.
C₂₇H₁₆N₂ Perylenedinitrile, P 607¹, 1351².
C₂₂H₁₈N₂O₂ Dinaphtho[1,2,3-*bc*,1,2,3-*cd*]phthalazine-7,14-dione, 4947⁷.
C₂₂H₁₈N₂O₂ Quinone, diphthalimido, 2430³.
C₂₂H₁₈O₂ Anthanthrone, 1758².
C₂₂H₁₈O₂ Benzo[*a*]naphthacene 5,6,8,13-tetrone, 4947⁷.
Dibenzo[*bc*]phenanthrene - 7,12,13,14-tetrone, 4947⁷.
Dibenzo[*γδ,αλ*]pyrene - 6,12 - dione, dihydroxy-, P 1758¹.
C₂₂H₁₈Br₂O₂ [Binaphthalene] - 8,8' - dicarboxylic acid, dibromo-, P 612², 4579¹.
C₂₂H₁₈Cl₂O₂ [1,1' - Binaphthalene] - 8,8' - dicarboxylic acid, 4,4' - dichloro-, P 609².
C₂₂H₁₈HgN₂O₂ 1 Naphthoic acid, 8,8'-mercuribis[3 nitro-, di Na salt, 3463¹.
C₂₂H₁₈N₂O₂ Hydroquinone, diphthalimido, 2430³.
C₂₂H₁₈N₂O₂ 2 - Benzotriazolophenazine, 2 (nitrophenyl-, 4216⁷, 4217^{1,3}.
C₂₂H₁₈O₂ Benzo[*a*]naphthacene - 8,13 - dione, 4947⁷.
Dibenzanthraquinone, 2967¹.
Dibenzo[*bc*]phenanthrene - 7,12 - dione, 4947⁷.
C₂₂H₁₈O₂ 7-Dibenz[*α,λ,μ*]anthracene-1-carboxylic acid, 7 keto-, P 849².
C₂₂H₁₈O₂ Benzoic acid, *o*-1-anthraquinonylcarboxyl-, 1896².
Spiro[phthalan - 1,1' - phthalan - 2',1'' - phthalan] 2,2''-dione, 1896².
C₂₂H₁₈BrO₂ 1 - Anthraquinonecarboxylic acid, 2-methyl-, *p* bromophenyl ester, 4606².
[1,1' - Binaphthalene] - 8,8' - dicarboxylic acid, bromo-, P 612².
C₂₂H₁₈N₂O₂ 1-meso-Anthrapyrrol-6(2)-one, 3-hydroxy-, benzoate, 2173².
C₂₂H₁₈N₂O Naphthophenazineoxazine, 1805².
C₂₂H₁₈ Benzo[*a*]naphthacene, 4947⁷.
Dibenzanthracene, 2966², 2967¹.
Dibenzo[*bc*]phenanthrene, 4947⁷.
C₂₂H₁₈ClNO Anthraquinone, benzamidochloromethoxy-, P 3104².
C₂₂H₁₈N Phenanthrene, 9,10-dihydro-9,10-di-2-isopyrrolydene-, 3466².
C₂₂H₁₈N₂O₂ Naphthalimide, *N*-naphthylamino, 4214¹.
C₂₂H₁₈N₂O₂ 1-Phthalazinol, 4,4'-*o*-phenylenebis-, 1896².
C₂₂H₁₈N₂O₂ 5 - *αβ* - Naphthotriazolol, 2 - (nitrophenyl)-4-phenylazo-, 4216², 4217^{1,3}.
C₂₂H₁₈O₂ 1,1'-Binaphthoyl, 3923².
C₂₂H₁₈O₂ 1-Anthraquinonecarboxylic acid, 2-methyl-, Ph ester, 4696¹.
[1,1' - Binaphthalene] - 2,2' - dicarboxylic acid, 1120².
Phthalide, 2,2'-*o*-phenylenebis-, 1896².
C₂₂H₁₈O₂ Alizarin, 3-methoxy-, benzoate, 4697².
1,2 - Benzanthrene - 7,12 - dione, 5,6 - dihydroxy-, diacetate, 5472⁴.
[1,1' - Binaphthalene] - 3,3' - dicarboxylic acid, 2,2'-dihydroxy, 5182⁴.
C₂₂H₁₈O₂ Atramentic acid, lactone, diacetate, 1127².
C₂₂H₁₈O₂ Aurintricarboxylic acid, NH₄ salt, 2171².
C₂₂H₁₈BrO₂ 2 - Naphthol, 1 - (1 - bromo - 2 naphthylmercapto)-, acetate, 2172².
C₂₂H₁₈ClN₂O₂ 4-Thiazolidone, 5-*o*-chlorobenzal-3-phenyl-2-phenylimino-, 821².
C₂₂H₁₈NO₂ Anthraquinone, 1-(benzamidomethyl) - 2 (and 4) - hydroxy -, 2173².
C₂₂H₁₈N₂O₂ 4-Thiazolidone, 5-*m*-nitrobenzal-3-phenyl-2-phenylimino -, 821².
C₂₂H₁₈N₂O₂ 4-Pyrazolecarboxylic acid, 3-(nitrophenyl) 1,5-diphenyl-, 3466², 3470².
C₂₂H₁₈ Ethylene, *γ* di-2-naphthyl-, 3443².
C₂₂H₁₈ClN₂O₂ Benzamide, 2-chloro 4,5-dihydro - 5 - keto - 3 - phenyl - 1 - pyrazolyl-, 3909².
C₂₂H₁₈Cl₂O Anthracene, 9 [(benzyloxy)methyl] 1,5-dichloro-, 3222².
Anthracene, 1,5 - dichloro - 9 - (methoxymethyl) 10 phenyl-, 3222².
C₂₂H₁₈Cl₂O Anthrone, 1,5-dichloro 10 phenyl-10 phenyl-, 3222².
C₂₂H₁₈N₂O₂ 2-Naphthalenecarbamic acid, dithio-, anhydride with 2 naphthalenecarbamic acid, 2953¹.
C₂₂H₁₈N₂O₂ Compl. m. 180-97°, from 1,3,5-triphenyl-4-pyrazolecarboxylic acid, 3469¹.
4-Pyrazolecarboxylic acid, 1,3,5-triphenyl-, 3469¹.
C₂₂H₁₈N₂O₂ 4 - Thiazolidone, 5 - *p* - hydroxybenzal - 3 - phenyl - 2 - phenylimino-, 821².
C₂₂H₁₈N₂O₂ 3-Cinnolinol, dihydro-, di Bz der., 4699².
Malonimide, *N* - [*p* - (*p* - sulcylalamino phenyl)phenyl]-, 3456².
C₂₂H₁₈N₂O₂ Anthraquinone, aminobenzamide methoxy-, P 3104².
2 - Indolecarboxylic acid, 1 - benzyl- (*o*-nitrophenyl-), 4699².
C₂₂H₁₈N₂O 2-Phenanthrothiadiazinone, methylhydrazono-, 140².
C₂₂H₁₈N₂O₂ Thiazole, 2-amino-5-(4-amino methyl) - 4 - phenyl, pieryl deriv., 1410².
C₂₂H₁₈O Ketone, methylnaphthyl naphthyl-, 2966².
C₂₂H₁₈O₂ 5(14)-Cerothione, 6,12 dimethyl-, 1896².
C₂₂H₁₈O₂ 1-Anthric acid, 2-methyl-, Ph ester, 4699².
Furan, 3-phenoxy-2,5-diphenyl-, 5471².
Ketone, *α*-hydroxybenzyl 1-naphthyl-, 3923².
C₂₂H₁₈O₂ Spiro[phthalide-2,9'-thioxanthene]-2',7'-dimethyl-, 1896².
C₂₂H₁₈O₂ Δ¹ - 1,4 - Butenedione, 2 - phenoxy-1,4-diphenyl-, 5471².

- Fluoran, dimethyl⁸, 2120⁸
 Glycolic acid, di-1-naphthyl-, 3923¹
 Phthalide, 2-[o-(o-tolyl)phenyl], 1896¹
C₂₂H₁₄O₄ 1,2 - Benzanthrene - 5,6 - diol, diacetate, 5472²
 Benzoic acid, o-[o-(o-tolyl)benzoyl]-, 1896⁷
C₂₂H₁₀O₄ Homogentisic acid, dibenzoate, 2706¹
C₂₂H₁₀O₅S 2(1) - Benzofuranone, 1 - benzal-5,6 - dihydroxy-, *p* - toluenesulfonate, 4698¹
C₂₂H₁₀O₅S Hystazarin, 1-methoxy-, *p*-toluene sulfonate, 4697⁸
C₂₂H₁₀O₆ Anthraquinone, 1,2,7,8 - tetrahydroxy-, tetraacetate, 2966⁷
 Rutiopin, tetraacetate, 2966⁷
C₂₂H₁₀Br Anthracene, benzylbromomethyl-, 5183¹
C₂₂H₁₀ClO Anthracene, 9-benzal-1-chloro-9,10-dihydro-10-methoxy-, 1408¹
 Anthracene, 1-chloro-10-*o*-methoxybenzyl-, 1408¹
C₂₂H₁₀NO Isoxazole, 3,5-diphenyl-4-tolyl-, 2709¹
C₂₂H₁₀NO₂ Anthraquinone, 3-methyl-1-*p*-toluino-, 2711⁸
C₂₂H₁₀NO₂ Benzil, methyl-, oxime, benzoate, 2709¹ 1547¹
 2-Naphthamide, 3-hydroxy-*N*-(3-methoxy-2-naphthyl)-, P 852¹
C₂₂H₁₀NO₂ Phenol, *p*-1-indanyl-, nitrobenzoate, 1130²
C₂₂H₁₀NO₂S Anthraquinone, 3-methyl-1-*p*-tolylsulfonamido-, 2711⁸
C₂₂H₁₀N₂O₂ Benzanilide, *p*-(4,5-dihydro-5-keto-3-phenyl-1-pyrazolyl)-, 3909⁸
C₂₂H₁₀N₂O₂ 2,6 - Pyridinediol, 3 - isopropyl-, bis(*p*-nitrobenzoate), 3665¹
C₂₂H₁₀ Anthracene, benzylmethyl-, 5183¹
C₂₂H₁₀BrN Aniline, *N*-(10-bromo-2-methyl-9-anthrylmethyl)-, 5183¹
C₂₂H₁₀Cl₂O 9 - Anthrol, 9 - benzyl - 1,5 - dichloro - 9,10 - dihydro - 10 - methoxy -, 3222²
 9 - Anthrol, 1,5 - dichloro - 9,10 - dihydro - 10 - methoxy - 9 - methyl - 10 - phenyl -, 3222²
C₂₂H₁₀N₂O Anthrone, 10 - (*p* - dimethylamino-phenylamino)-, 3919²
 Ketone, 1 - methyl - 3 - phenyl - 2 - indylphenyl, oxime, 4699¹
C₂₂H₁₀N₂O Anthraquinone, 1-methylamino-4-*p*-toluino-, P 5194¹
 Naphthalenediamine, bis(hydroxyphenyl)-, P 2014¹
 1,3,4,6 - Oxidiazin - 5(4) - one, 2 - methyl-4,6,8-triphenyl-, 1904²
 2,5 - Piperazinedione, 3,6 - dicinnamal-, 5469¹
 Triphenodioxazine, 6-isopropyl-13-methyl-, 1895²
C₂₂H₁₀N₂O₂S Triphenodithiazine - 6,13(7,14)-dione, 3,10-dietoxy-, 4823¹
C₂₂H₁₀N₂O₂ 2,5 - Piperazinedione, 3,6 - bis(*m*-hydroxybenzyl)-, diacetate, 4684¹, 5469¹
 2,5-Piperazinedione, 3,6-disalicylal-, diacetate, 4684¹
C₂₂H₁₀N₂O 1,3,4 - Triazole - 1 - *o* - benzanilide, 2-methyl-5-phenyl-, 836²
C₂₂H₁₀N₂O₂ 1,3,4,2 - Thiodiazin - 2 - one, 3,4-dihydro - 4,8 - diphenyl-, azine with salicylaldehyde, 1469¹
C₂₂H₁₀N₂O Phthalazine - 4 - acetic acid, 1-hydroxy - 3 - (3' - nitrophenyl) - 1,3 - dihydro-, anilide, 146¹
C₂₂H₁₀N₂O Pseudoindolol, 3,3-dimethyl-2-phenyl-, pterate, 3927⁸
C₂₂H₁₀N₂O₂ Δ² Oxazoline, 4-methyl-2,5-di-phenyl-, pterate, 3690¹
C₂₂H₁₀N₂O 1,3,4 - Triazole, 2 - methyl - 5-phenyl-1-*o*-tolyl-, pterate, 836²
C₂₂H₁₀O Acetylphlorone, *p* methyl-*β*,*β*-di-phenyl-, 4187²
 2-Propin-1-ol, 1,1-diphenyl-3-*p*-tolyl-, 1187²
C₂₂H₁₀O Benzene, ditolyl-, 3915¹
β-Butenic acid, α , γ , γ -triphenyl-, 5181²
 Phenol, *p*-1-indanyl-, benzoate, 1130²
C₂₂H₁₀O₂S Benzoic acid, *o*-(2,7-dimethyl-9-thioxanthyl)-, 1896⁷
C₂₂H₁₀O₂S Phthalic acid, dithio-, ditolyl ester, 127¹
C₂₂H₁₀O₂ 1,4-Butanedione, 2-phenoxy-1,4-di-phenyl-, 5471¹
 Phthalide, 2-[*o*-(α -hydroxy-*o*-methylbenzyl)phenyl], 1896¹
C₂₂H₁₀O Benzoic acid, *o*,*o'*-xylylenesul-, 1896⁷
 Cresolphthalon, 2120⁸
 Ethanol, 1,2-diphenyl-, acid phthalate, 121¹
 Phthalic acid, dibenzyl ester, P 2449²
C₂₂H₁₀O₂S 3-Isoxanthene-9-*o*-benzenesulfonic acid, 3 - keto - 2,6,7 - trimethoxy -, and Na salt, 2964¹
C₂₂H₁₀O₂ Chlorone, trihydroxymethylenedioxy-, triacetate, 2431¹
C₂₂H₁₀PbS Plumbane, triphenyl 2-thienyl-, 4699¹
C₂₂H₁₀SSn Stannane, triphenyl-2-thienyl-, 4699¹
C₂₂H₁₀As₂N₂O Benzenearsonic acid, *p*-(3-amino-2-*p*-anisyl-4-quinolylazo)-, 839¹
C₂₂H₁₀Cl₂O Methane, \bullet tris(5-chloro-*o*-anisyl)-, 1129¹
C₂₂H₁₀Cl₂O Carbinol, tris(5-chloro-*o*-anisyl)-, 1129¹
C₂₂H₁₀N Aniline, *N*-(2-methyl-9-anthrylmethyl)-, 5183¹
 Indole, 2-benzyl-1-methyl-3-phenyl-, 4699¹
C₂₂H₁₀NO 2-Naphthylamine, *N*-(ϵ -*p*-anisyl-3,4-pentadienyldene)-, 3912¹
C₂₂H₁₀NO₂ Anthranilic acid, *N*-(5-benzoyl-*o*-tolyl)-, Me ester, 839⁸
C₂₂H₁₀N₂O Aniline, *N*-*p*-methoxycinnamal-*p*-phenylazo-, 3911²
C₂₂H₁₀N₂O Compd. from lactone of α -benzylamino - β - hydroxycinnamic acid and PhNHNH₂, 1121²
C₂₂H₁₀N₂O₂S *p* - Toluenesulfonamide, 3' - (4,5-dihydro - 5 - keto - 3 - phenyl - 1 - pyrazolyl)-, 3909²
C₂₂H₁₀N₂O₂S Azure C, acetylacetylate, 4043¹
C₂₂H₁₀N₂O Pseudoisatin, 1-acetyl-, phenylsulfone, 2970¹
C₂₂H₁₀N₂S 1,2,4 - Triazole, 3 (and 5) - (benzylmercapto) - 1 - phenyl - 5 (and 3) - (β -phenylthioacarbamido)-, 2178¹
C₂₂H₁₀CIN 3,3-Dimethyl-1,2-diphenylpseudoindolum chloride, 4699⁸
C₂₂H₁₀CINO 3,3 - Dimethyl - 1,2 - \bullet phenylpseudoindolum perchlorate, 4699⁸
C₂₂H₁₀Cl₂O Ether, β , β -dichloroisopropyl triphenylmethyl-, 2152¹
C₂₂H₁₀N₂O Isobutyrophenone, α -(*o*-anilino phenyl)-, nitroso deriv., 4699⁸
 Δ^2 - 4 - Isoxazolinol, 5 - anilino - 3 - methyl-4,5-diphenyl-, 2974¹
C₂₂H₁₀N₂O₂S Thionaphthalenaldehyde, ethoxyhydroxy-, azine, P 2447¹
C₂₂H₁₀N₂O₂S Oxazolidine, 5-(hydroxymethyl)-

- 3 - (phenylsulfonyl) - 2 - (phenylsulfonylimino) - (?), benzenesulfonate, 2177².
- Δ^2 - Oxazoline, 5 - (hydroxymethyl) - 2 - [bis(phenylsulfonyl)amino] - (?), benzenesulfonate, 2177².
- C₂₂H₂₀N₄** Fluorindine, 6-isopropyl-13-methyl-, 1895⁹.
- C₂₂H₂₀N₄O₂** Norpseudoephedrine, benzoate, picrate, 3690².
- C₂₂H₂₀N₄S** 1,2,4-Triazol-3(2)-one, dibenzyl-4,5-dihydro - 5 - imino - 4 - phenylthio -, 1640¹.
- C₂₂H₂₀N₄O₂S₂** [4,4'-Bi- Δ^2 -pyrazoline]-1,1'-dicarboxanilide, 5,5' - diketo - 3,3' - dimethyl-dithio-, 388⁸.
- C₂₂H₂₀N₄O₂S₂** Flavianic acid, ethylenediamine deriv., 4702².
- C₂₂H₂₀O** 2-Butanone, 1,3,4-triphenyl-, 2171³.
- Ethylene oxide, α, α - dibenzyl - β - phenyl -, 2958⁸.
- Ketone, 1 (and 2)-naphthyl 5,6,7,8-tetrahydro - 3 - methyl - 2 - naphthyl, 4947².
- Stilbene, α - β phenetyl-, 1794⁷.
- C₂₂H₂₀O₂** Butyric acid, triphenyl-, 5181³.
- Phthalan, 2-ethoxy-1,1-diphenyl-, 1409⁷.
- Stilbene, α - β - anisyl - β - methoxy-, 1794⁷.
- C₂₂H₂₀O₂** Quinone, 2-(α, β -diphenylisopropyl) - 5-methoxy-, 4682⁴.
- C₂₂H₂₀O₂** Quinone, 2,5-di- β -anisyl-3,6-dimethoxy-, 1127⁴.
- C₂₂H₂₀O₂** $\Delta^2(4)$, α - Furanacetic acid, $\alpha, 4$ - di- β - anisyl - 5 - keto - 3 - methoxy-, Me ester, 1128⁴.
- C₂₂H₂₀O₂** Coniferal diphenylglucoside, 2983³.
- Kikokunetin, tri-Ac deriv., 2717¹.
- C₂₂H₂₀Cl** Methane, chloro- α -tolyl-di- β -tolyl-, 5182³.
- C₂₂H₂₀ClN₂O₂** Bi- α - anisidine, N - (5-chlorovanillal)-, 4456⁷.
- C₂₂H₂₀ClN₂O₂** β -Toluidine, N, N' -(5-chlorovanillal)bis[3-nitro-, 4456⁷.
- C₂₂H₂₀N** Indoline, 3,3-dimethyl-1,2-diphenyl-, 4699⁸.
- C₂₂H₂₀NO** 2-Indofolol, 3,3-dimethyl-1,2-diphenyl-, 4699⁸.
- Isobutyrophenone, α -(α -anilino-phenyl)-(?), 4699⁸.
- C₂₂H₂₀NO₂** Acetanilide, 3,4-bis(benzoyloxy)-, 3677⁴.
- C₂₂H₂₀NO₂S** 2-Propanone, 1,3,4-diphenyl-, oxalate, p -toluenesulfonate, 1895⁹.
- C₂₂H₂₀NO₂** Desmethyltrikobinol, diacetyl deriv., 393³.
- C₂₂H₂₀N₂O₂** Thymoquinone, 5-(2,4-dinitrophenylhydrazon) 2-(α -nitrophenylhydrazon), 4679⁸.
- C₂₂H₂₀Br₂O₂** 1,6-Hexanediol, 2,5-dibromo-2,5-bis(bromomethyl)-, dibenzoate, 4928².
- C₂₂H₂₀ClN₂O₂** 6-Acetamido- α -(β -acetamidobenzal)-1-methylquinazolinium chloride, 4960².
- C₂₂H₂₀ClO₂P** Phosphine, chloroisopropoxy(triphenylmethoxy)-(?), 3921⁴.
- Phosphine, chloropropoxy (triphenylmethoxy)-(?), 3921⁴.
- Phosphine oxide, chloroisopropoxy(triphenylmethyl)-(?), 3921⁴.
- , chloropropoxy(triphenylmethyl) - (?), 3921⁴.
- C₂₂H₂₀N₂** Isobutyrophenone, β, β -diphenylhydrazones, 4699⁸.
- α - Teluamidine, N, N' - dibenzyl-, 1895⁹.
- C₂₂H₂₀N₂O** Acetanilide, dibenzylamine-, 378².
- Urea, α - (β, β' - diphenylisopropyl) - β - phenyl-, 4470².
- C₂₂H₂₀N₂O₂** Barbituric acid, 5,5-diethyl-1,3-bis-(p -nitrobenzyl)-, 821⁴.
- C₂₂H₂₀N₂O₂** Camphanoquinoxaline, 7(or 8) - amino-, picrate, 2169².
- C₂₂H₂₀O** Anisole, dibenzylmethyl-, 131¹.
- C₂₂H₂₀O₂** 1,2-Propanediol, 2-benzyl-1,3-diphenyl-, 2171³.
- C₂₂H₂₀O₂** Cyclohexanone, 2,6-dianisal-, 3687².
- C₂₂H₂₀O₂** Benzene, 1,3-bis (benzyloxy)-2, 5 dimethoxy-, 2181⁷.
- 1,6 - Hexanediol, 2,5 - dimethylene-, dibenzoate, 4928².
- C₂₂H₂₀O₂** Cyclohexanone, divanillal-, and -HCl-, 3887².
- C₂₂H₂₀O₂S** Coumarin, 3-acetyl-6,8 diethyl-5 hydroxy-, p - toluidenesulfonate, 3210⁴.
- C₂₂H₂₀Br₂N₂O₂** Vomisine, bromo-, 3474⁴.
- C₂₂H₂₀IN₂O₂** 2-Ethyl-1-[γ -(2-ethyl-1,2-benzothiazylidene) - β - methylpropenyl - benzothiazolium iodide, 1903².
- C₂₂H₂₀NO** Phenethyl alcohol, β -amino α, α - dibenzyl-, 1892⁴.
- C₂₂H₂₀NO₂** 2-Naphthoic acid, 4-(β -dimethylamino - α - methoxybenzyl) - 3 - hydroxy-, Me ester, and -HCl, 3221⁴.
- C₂₂H₂₀NO₂S** 2-Propanone, 1-amino-1,3-diphenyl-, p -toluenesulfonate, 1895⁹.
- C₂₂H₂₀NO₂** 8-Dibenzozquinolinone, 5,6-dihydro - 2,3,9,10 - tetramethoxy - 13-methyl-, 843¹.
- C₂₂H₂₀NO** See *Narcotine*.
- C₂₂H₂₀NO₂** Narcotine, amine oxide, and salt, 4224⁴.
- C₂₂H₂₀NO₂** Protocatechuyl alcohol, α -taperonylaminoethyl-, 3,4 - diacetate, oxalate, 5162³.
- C₂₂H₂₀N₂O₂** Anhydrocotarnine-2-nitro-3,4-dimethoxyphenylacetone, 5177².
- C₂₂H₂₀N₂O₂** Cinchophen, compd. with hexamethylenetetramine, 5185².
- C₂₂H₂₀ClNO₂** 2-Naphthoic acid, 4-(β -dimethylamino - α - methoxybenzyl) - 3 - hydroxy-, Me ester, oxonium -HCl, -HCl, 3221⁴.
- C₂₂H₂₀N₂O₂** Camphorinide, N -(β -amino-phenyl)phenyl-, 127⁴.
- Cinchoninamide, N, N -diethyl 2 β phenylethoxy-, P 1217⁴.
- C₂₂H₂₀N₂O₂** Desoxyvomisine, 3474⁴.
- C₂₂H₂₀N₂O₂** 4,4'-Bi[quinazolinic acid], 1,1', 2,2',3,3',4,4' - octahydro-, di-Me ester, 1411⁴.
- Vomisine, and -HCl, 3474⁴.
- C₂₂H₂₀N₂O₂** 2,5-Pyrazinedicarboxylate, 2,5-dihydro-3,6-dimethyl-, 835².
- C₂₂H₂₀N₂O₂** 2,5-Pyrazinedicarboxylic acid, 2,5-dihydro-3,6-dimethyl-, 835².
- C₂₂H₂₀O₂** 1,8-Cyclohexanediol, di- α - toluidine-, 4677².
- Diacetate, m. 165°, of compd. m. 181°, 4689².
- C₂₂H₂₀O₂** Acetate, m. 150-2°, of compd. m. 185-8°, 150².
- Isosavone, 3',4',5,5',6,7-hexamethoxy-2-methyl-, 2180².
- Isosavone, β -mono-, disaliclate, 4685².
- C₂₂H₂₀O₂** Tectoridin, 2717².
- C₂₂H₂₀Fb** Plumbane, butyltriphenyl-, 1888².
- Plumbane, *sec*-butyltriphenyl-, 1888².
- , *tert*-butyltriphenyl-, 1888².
- , isobutyltriphenyl-, 1888².
- C₂₂H₂₀N** Stannane, butyltriphenyl-, 118².
- C₂₂H₂₀Br₂N₂O** Vomisine, dihydrobromo-, 3474⁴.

- C₂₂H₁₈BrO₈ 1,4-Pyrone, 2-methyl-6-phenyl, bromocampophorsulfonate, 142⁹.
- C₂₂H₁₈IN₂O₂ Desoxyvomine, iododihydro-, 3474⁹.
- C₂₂H₁₈NO Quinoline, 4-ethyl-6-isoamoxy-2-phenyl-, 2443⁹.
- C₂₂H₁₈NO₂ Lobelanine, 4706⁸.
- C₂₂H₁₈NO₂ Lobelanine, N-oxide, and its HCl, 4706⁸.
- C₂₂H₁₈NO₂ Laurotetanine, N-acetyl, O-Me ether, 1412¹.
- C₂₂H₁₈NO₂ See Colchicine.
- C₂₂H₁₈NO₂ Protocatechuyl alcohol, α (α-benzylaminoethyl) - 3,4 - diacetate, oxalate, 5162⁷.
- C₂₂H₁₈N₂O₂ Cinchoninanilide, 2 (diethylamino ethoxy)-, P 1217⁸.
- C₂₂H₁₈N₂O₂ Anhydrolaudanine - 2-nitro-3,4-dimethoxyphenylacetone, 5177⁸.
- C₂₂H₁₈N₂O₂ Glycine, N-[N-(β-phenyl-N-phenylcarbamylalanyl) glycol] glycol-, 2992⁹.
- C₂₂H₁₈Br₂O₂ Olivil, dibromodimethyl-, 5188⁸.
- C₂₂H₁₈INO₂ α-Homotrilobanemethylmethine, methiodide, 393¹.
- C₂₂H₁₈N₂O Pseudostrychnidine, methyl-, 3711³.
- C₂₂H₁₈N₂O₂ Aniline, bisisopropenyl, diacetyl deriv., 4688⁹.
- C₂₂H₁₈N₂O₂ Desoxyvomine, dihydro-, 3474⁹.
- C₂₂H₁₈N₂O₂ Vomine, dihydro-, 3474⁹.
- C₂₂H₁₈N₂O₂ Vomine, acid, 3474⁹.
- C₂₂H₁₈N₂ Methane, (aminopyridyl)-11-methylaminophenyl-, 143⁹.
- C₂₂H₁₈N₂O₈ Uracil, 6-[p,p'-bis(dimethylamino)benzohydril]-5-methyl-2-thio-, 2445⁴.
- C₂₂H₁₈N₂O₂ Uracil, 6-[p,p'-bis(dimethylamino)benzohydril]-5-methyl-, 2445⁴.
- C₂₂H₁₈O₂ Anisole, 2,2'-(ethylenedioxy)-bis(5-allyl-, 380⁹.
- m-Cresol, butyridenebis-, diacetate, 4690⁹.
- Malonic acid, benzylmethylbenzyl, diethyl ester, 2706⁸.
- Phenol, p,p'-(1,3-trimethyltrimethylene)bis-, diacetate, 4688⁹.
- , p,p'-(1,1,3-trimethyltrimethylene)bis-, diacetate, 4688⁹.
- C₂₂H₁₈BrN₂O₂ Strychnine, dihydro, metho-bromide, 3711³.
- C₂₂H₁₈BrO₂ Olivil, bromodimethyl-, 5188⁸.
- C₂₂H₁₈ClN₂O Strychnidine, methochloride, 3711³.
- C₂₂H₁₈ClN₂O₂ Strychnine, dihydro, methochloride, 3711³.
- C₂₂H₁₈IN₂O₂ Strychnine, dihydro, methiodide, 3711³.
- C₂₂H₁₈NO α-Curcumene, oximino, Bz deriv., 149⁹.
- C₂₂H₁₈NO₂ Lobeline, 4706⁸, and salts, 4707.
- C₂₂H₁₈NO₂ Codeinone, butyryldihydro-, -HBr, P 5474⁹.
- Corydaline, 4223⁴.
- C₂₂H₁₈NO₂ Sekisanoline, diacetyl deriv., 4223⁴.
- C₂₂H₁₈N₂O₂ Lobelanine, dioxime, 4706⁸.
- Lobelinic acid dianilide, 4706⁸.
- C₂₂H₁₈N₂O₂ Alanine, β-phenyl-N-(N-phenylcarbamyleucyl)-, 1112¹.
- C₂₂H₁₈N₂O₂ Alanine, N-[N-(4-nitro-2-tolyl-sulfonyl)leucyl]-β-phenyl-, 1112¹.
- C₂₂H₁₈N₂O₂ Acetamide, α,α'-iminobis[N-(α-phenylcarbamylethyl)-, 1112¹.
- C₂₂H₁₈ Naphthalene, dicyclohexyl-, 4936⁹.
- C₂₂H₁₈BrN₂O₂ 1,1-Dimethyl-1,4-diphenacyl-1,4-piperazinium dibromide, 2117⁸.
- C₂₂H₁₈CINO₂ Glucosidyl β-chlorobenzylmethanamide, tetraacetyl-, and -HCl, 4450⁷.
- C₂₂H₁₈INO₂ Thebaizone, dihydro-, methiodide, Ac deriv., 1613².
- C₂₂H₁₈NO₂ Acetamide, p,p'-2,5-hexylenebis-, 4688⁹.
- Acetamide, p,p'-α-methylpropylidenebis-[N-methyl-, 4689⁹.
- , p,p'-(1,1,3-trimethyltrimethylene)bis-, 4688⁹.
- Base, m 213², from reduction of desoxyvomine, 3474⁹.
- 3,3'-Biotomeside, 1406⁹.
- C₂₂H₁₈NO₂ See Colchicine.
- C₂₂H₁₈NC₂ Resorcyldaldehyde, 3,5-diethyl-, azine, 3219⁶.
- C₂₂H₁₈N₂ See Camphor.
- C₂₂H₁₈N₂O Camphor, 3,2,5-dihydro-2,5-dimethyl-1-pyridyl-, picrate, 2961¹.
- C₂₂H₁₈O Olivil, dimethyl-, 5188⁸.
- Olivil, ethyl-, 5188⁸.
- C₂₂H₁₈BrNO₂ Bromine deriv., m. 159⁹, of base m. 179⁹, 3474⁹.
- C₂₂H₁₈ClNO Strychnidine, dihydro-, methochloride, 3710³.
- C₂₂H₁₈IN₂O Strychnidine, dihydro-, methiodide, 3710³.
- C₂₂H₁₈NO₂ Laudanine, 4706⁸.
- C₂₂H₁₈NO₂ Morphothebane, dimethyl, methosulfate, 2978⁸.
- C₂₂H₁₈NO₂ Glucosidyl benzylmethanamide, tetraacetyl-, and -HCl, 4450⁷.
- C₂₂H₁₈N₂O Strychnidine, methoxytetrahydro-, nitroso deriv., 3711³.
- C₂₂H₁₈N₂O₂ Norvaline, A {α [N-(2-naphthyl-sulfonyl)cycloamino]valeryl-, 2993².
- Valine, N-[N-(N-(2-naphthylsulfonyl)glycyl)valyl-, 2993².
- C₂₂H₁₈N₂ Amine, p,p'-cyclohexylidenebis[N,N'-dimethyl-, and -HCl, 4688⁹.
- C₂₂H₁₈N₂O Base, m. 179⁹, from reduction of desoxyvomine, 3474⁹.
- strychnidine, methoxytetrahydro-, 3711³.
- C₂₂H₁₈N₂ 4,5-Indolone, 6,7-dihydro-6,6,6-trimethyl-, azine, 2716⁶.
- C₂₂H₁₈N₂O₂ Urea, α-phenyl-α-propyl-, oxalate, 3412³.
- C₂₂H₁₈O Amyl, benzoate, 1127³.
- C₂₂H₁₈O₂ 5052².
- C₂₂H₁₈O₂ Gluco-idohexanetetrol anhydride, pentaacetyl-, 3671².
- C₂₂H₁₈BrN Trimethyl-β-phenethyl-ε-phenyl-aminium bromide, 2934⁹.
- C₂₂H₁₈N₂ Aniline, p,p'-α-methylamylidene)bis-[N,N'-dimethyl-, 4689⁹.
- C₂₂H₁₈N₂O Benzoyl deriv. of compd. from sparteine, salts, 5188⁸.
- Compd. from sparteine, salts, 5188⁸.
- α-Curcumenentrolbenzylamine, 149⁹.
- C₂₂H₁₈N₂O₂ Cinchonamide, 2-ethoxy-N,N-diisomyl-, P 1217⁸.
- C₂₂H₁₈N₂O₂ Pyrocatechol, 4-(propylamino-methyl)-, oxalate, 5162⁷.
- C₂₂H₁₈O₂ Ketone, m. 206⁹, from acid, m. 278⁹, 152⁹.
- C₂₂H₁₈O₂ Me ester, m. 180⁹, of acid m. 252-3⁹, 149⁹.
- C₂₂H₁₈O₂ Caproin, α, γ-di-, salicylate, 4655⁴.
- C₂₂H₁₈O₂ Gluco-idohexanetetrol anhydride pentaacetyl-, 3671².
- C₂₂H₁₈O₂ Bisdesoxycellobiose, pentaacetyl-, 3671².

- C₂₂H₃₃NO₃ Oxime, m. 248°, of ketone, m. 200°, 152°.
- C₂₂H₃₃N₂O₂ Cinchoninic acid, 2-(diethylaminoethoxy)-, diethylaminoethyl ester, P 1995°.
- C₂₂H₃₃O₂ Abietic acid, Et ester, 3820°, P 4229°. Clupanodonic acid, 4671°. Iwashi acid, 1108°. Pimaric acid, Et ester, 4224°.
- C₂₂H₃₃O₄ Agathidicarboxylic acid, di-Me ester, 3711°.
- C₂₂H₃₃Br₂O₂ Behenic acid, octabromo-, 4928°.
- C₂₂H₃₃O₂ Acid from sardine oil, 4928°.
- C₂₂H₃₃O₂ Cyclogallipharic acid, Me ester, 3825°.
- C₂₂H₃₃O₂ Glucoside, 3,4,6-triacetyl-β-menthyl-, 1881°.
- C₂₂H₃₃BrN₂O: Alanine, (α-bromoisocaproyl) glycyllalanylleucylglycyl-, 2992°.
- C₂₂H₃₃N₂O₄ Leucine, N, N' - (N, N' - oxalylbis-glycyl)bis-, di Et ester, 1389°.
- C₂₂H₃₃N₂O₅ Hexamethylenetetramine, thymol-sulfonate, 4189°.
- C₂₂H₃₃O₄ Agathidicarboxylic acid, tetrahydro-, di-Me ester, 3711°.
- C₂₂H₃₃N 2,6-Lutidine, 4 pentadecyl-, and salt, 1902°.
- C₂₂H₃₃N₂ Hydrazine, α-cetyl-α-phenyl-, -HCl, 4214°.
- C₂₂H₃₃O₂ (See also *Behenic acid*.)
Eleostearic acid, Bu ester, 2151°.
- C₂₂H₃₃O₄ 1,9 Nonanediol, θ-hydroxypelargonate, diacetate, 3663°.
- C₂₂H₃₃HgO₂ 1-Hexadecene, mercuric propionate compd., 3899°.
- C₂₂H₃₃O₂ (See also *Brazydric acid*)
Erucic acid, 294°, 5053°.
- C₂₂H₃₃O₄ 1,20 - Eicosanedicarboxylic acid, 1111°.
- n-Eicosic acid, γ-hydroxy-, acetate, 3664°.
- C₂₂H₃₃N₂O Cycloheineicosanone, semicarbazone, 1111°.
- C₂₂H₃₃ 1-Docosene, 4669°.
- C₂₂H₃₃O₂ Behenic acid, 556°.
- C₂₂H₃₃O₂ Heneicosanoic acid, ν-hydroxy-, Me ester, 3664°.
- C₂₂H₃₃Br Docosane, 1-bromo, 4669°.
- C₂₂H₃₃BrCl₂Mg₂O₄ Etherate from PhMgBr and PCl₅, 2158°.
- C₂₂H₃₃N 2,6-Lupetidine, 4 pentadecyl-, and salt, 1902°.
- C₂₂H₃₃ Docosane, 4438°.
- C₂₂H₃₃NO₅ 3,4,9 - Perylenetricarboxylic acid, 10-sulfo-, cyclic 3,4-anhydride 9,10 imide, 1130°.
- C₂₂H₃₃N₂ Perylenetrinitrile, 1130°.
- C₂₂H₃₃ClO 7 - meso - Benzanthrenone, chloro phenyl-, P 3109°.
- C₂₂H₃₃NO₂ 5,6 - β - Naphthoquinoline - 7,12 - dione, 3707°.
- C₂₂H₃₃NO Anthraquinone, 2 - hydroxy - 1 - phthalimidomethyl-, 2173°.
- C₂₂H₃₃O₂ Anthraruflin, 4 (2 - phthalimido - methyl-, 2173°.
- C₂₂H₃₃N₂O₅ α-Benzophenazine, 5(?)-(α-carboxyphenylsulfinyl)-, 1901°.
- C₂₂H₃₃O 7 - meso - Benzanthrenone, phenyl-, P 1139°, P 1143°, P 2580°, P 3479°.
- C₂₂H₃₃O₅ 7 - meso - Benzanthrenesulfonic acid, 2-hydroxy-7-keto-1-phenyl-, P 1139°.
- C₂₂H₃₃O Anthragallol, monoacetate, mono-benzoate, 4697°.
- C₂₂H₃₃BrNO₂ 5(4) - Oxazolone, 4 - [3,5 - di-bromo - 4 - (p-methoxyphenoxy)benzal]-2-phenyl-, 5172°.
- C₂₂H₃₃Cl₂NO₂ 5(4) - Oxazolone, 4 - [3,5 - dichloro - 4 - (p-methoxyphenoxy)benzal]-2-phenyl-, 5173°.
- C₂₂H₃₃N 5,6-β-Naphthoquinoline, 3-phenyl-, and -HCl, 3707°.
- C₂₂H₃₃NO 7-meso-Benzanthrenone, 3-amino-1-phenyl-, P 1139°.
- 7 - meso-Benzanthrenone, 4-amino-, 4945°.
- C₂₂H₃₃NO₂ 2,3-Quinolinediol, dibenzoate, 2442°.
- C₂₂H₃₃NO₂ Δ⁹.α - Fluoreneacetic acid, α - hydroxy-, Me ester, p-nitrobenzoate, 832°.
- Phthalic acid, N-(2-hydroxy-1-anthraquinonylmethyl)-, 2173°.
- C₂₂H₃₃MoN₂O₅S₂, 2899°.
- C₂₂H₃₃N₂O₂ Cinchoninolhydroxamic acid, 2-phenyl-, Bf deriv., 4470°.
- C₂₂H₃₃N₂O₅ 4 - Thiazolidone, 3 - phenyl - 2-phenylimino - 5 - piperonylidene-, 8211°.
- C₂₂H₃₃N₂O₅ Benzoic acid, o-(3,4-diketo-1(-)-naphthylsulfinyl)-, phenylhydrazon-, 1901°.
- C₂₂H₃₃O Anthrone, cinnamal, P 2579°; and deriv., P 3583°.
- C₂₂H₃₃O₂ Anthraquinone, 1-hydroxy-2,3-dimethoxy-, benzoate, 4697°.
- C₂₂H₃₃ClO₂ 9 - Anthracenecarbinol, 4 - chloro α-phenyl-, acetate, 1408°.
- 9-Anthrol, 10-benzal-4-chloro-9,10-dihydro-, acetate, 1408°.
- C₂₂H₃₃NO₂ Phthalamic acid, N-(α-carboxy β,β-diphenylethyl)-, anhydride, 3690°.
- C₂₂H₃₃BrNO₂ Acrylophenone, p amino-β-ethylideneamino-α,β-diphenyl-, 142°.
- C₂₂H₃₃Cl₂O Anthracene, 9-benzal-1,5-dichloro-10-ethoxy 9,10 dihydro-, 3222°.
- Anthracene, 1,5 - dichloro - 9 - (ethoxymethyl)-10-phenyl-, 3222°.
- C₂₂H₃₃HgO₂ Aurin, bis(acetoxymercuri)-, 4943°.
- C₂₂H₃₃N₂O₅ 4 - Thiazolidone, 5 - p - methylbenzal - 3 - phenyl - 2 - phenylimino - 8211°.
- C₂₂H₃₃N₂O₅ 4 - Thiazolidone, 5 - amsal 3-phenyl-2-phenylimino -, 8211°.
- 4 - Thiazolidone, 5 - α - methoxybenzal 3-phenyl-2-phenylimino-, 8211°.
- C₂₂H₃₃N₂O₅ 3-Triazole, 3-(benzylmercapto)-5-dibenzoylamino-, 2178°.
- C₂₂H₃₃O₂ Puran, 2,5-diphenyl-3-β-toloxyl-, 5471°.
- C₂₂H₃₃O₂ Δ² - 1,4 - Butenedione, 1,4 - diphenyl-2-m-toloxyl-, 5471°.
- C₂₂H₃₃O₂ Δ² - 1,4 - Butenedione, 2 (m-aminooxy)-1,4 - diphenyl-, 5471°.
- Hydroquinone, allyl, dibenzoate, 2706°.
- C₂₂H₃₃O₂ Homogentisic acid, Me ester, dibenzoate, 2706°.
- C₂₂H₃₃BrClNO Isoxazole, 5-(p-bromophenyl)-3,4 - diphenyl-, ethochloride, 142°.
- C₂₂H₃₃BrCl₂FeNO Isoxazole, 5 - (p - bromophenyl) - 3,4 - diphenyl-, ethochloride, FeCl₃ compd., 142°.
- C₂₂H₃₃BrN₂O₅ Anthraquinone, amino-bromoethylmercapto)toluino-, P 3109°.
- C₂₂H₃₃ClO Anthracene, 1-chloro-10-α-ethoxybenzyl-, 1408°.
- C₂₂H₃₃NO Acrylophenone, β-ethylideneamino-α,β-diphenyl-, 142°.
- Isoxazole, 4-phenyl-3,6-di-o-tolyl-, 2709°.
- C₂₂H₃₃NO₂ Benzil, methyl-, oxime, o-toluate, 2709°.
- C₂₂H₃₃NO₂ Pseudoisatin, dianisylmethyl-, P 1277°.

- C₂₅H₁₁N₃O Δ² - Isoxazolin⁶, 5 - (o - benzalamino-phenyl) - 4 - imino - 3 - methyl - 5 - phenyl-, 2974⁶.
- C₂₁H₁₀BrNO Δ¹ - 5 - Isoxazolinol, 5 - (p - bromophenyl) - 2 - ethyl - 3,4 - diphenyl-, 142⁶.
- C₂₁H₁₀ClNO Isoxazole, triphenyl-, ethochloride, *FeCl₃ compd.*, 141⁹.
- C₂₁H₁₀Cl₂O 9 - Anthrol, 1,5 - dichloro - 10 - ethoxy - 9,10 - dihydro - 9 - methyl - 10 - phenyl-, 3222⁶.
- C₂₁H₁₀Cl₂O Δ¹ - Cyclohexenecarboxylic acid, 6 - (chlorophenyl) - 4 - (chlorostyryl) - 2 - keto-, Et ester, 831⁴.
- C₂₁H₁₀Cl₂FeNO Isoxazole, triphenyl-, eth⁶ chloride, *FeCl₃ compd.*, 141⁹.
- C₂₁H₁₀NNaO Δ¹ - 5 - Isoxazolinol, 2 - ethyl - 3,4,5-triphenyl-, Na deriv., 142¹.
- C₂₁H₁₀NrO Ketone, 1-ethyl-3-phenyl-2-indyl phenyl, oxime, 4699⁴.
- C₂₁H₁₀N₂O₂ Glyoxylamide, α-(o-benzamido-phenyl)-N-phenethyl-, 5186⁴.
- C₂₁H₁₀N₂O₂ Cinnamic acid, p-methoxy, p - (p-anisylazo)phenyl ester, 1396⁹.
- C₁₁H₁₀O₂ 1,4 - Butanedione, 1,4 - diphenyl - 2 - p-toloxo-, 5471⁶.
- C₁₁H₁₀O₂ Δ^{1,4} - 3,5 - Heptadienedione, 1,7-bis(m - hydroxyphenyl)-, bis(methylcarbonate), 4211⁶.
- C₁₁H₁₀ClN₂O₂ Benzoic acid, m-(5-chlorovanillalamino)-, picrate, EtOH compd., 4456⁶.
- C₁₁H₁₀ClO₂ Δ¹ - Cyclohexenecarboxylic acid, 4 - (chlorostyryl)ketophenyl-, Et ester, 831^{3,4}.
- C₁₁H₁₁N Indole, 2 - benzyl - 4,7 - dimethyl - 3 - phenyl-, 4699⁴.
- Indole, 2-benzyl-1-ethyl-3-phenyl-, 4699⁴.
- Pseudoindole, 3,3 - dibenzyl - 2 - methyl-, and - HCl, 3927^{1,8}.
- C₁₀H₁₁NO Acrylophenone, β-ethylamino-α,β-diphenyl-, 142¹.
- C₁₁H₁₁NO₂ 2-Indolinol, 1-benzoyl-3,3-dimethyl-2-phenyl-, 3927⁴.
- Δ¹ - 5 - Isoxazolinol, 2 - ethyl - 3,4,5 - triphenyl-, 142¹.
- C₁₁H₁₁NO₂ Glutaramic acid, diphenyl-, 4930³.
- Norephedrine, N-benzoyl-, benzoate, 2705².
- Norpseudoephedrine, N-benzoyl-, benzoate, 2705².
- C₁₁H₁₁NS β-Butenamide, β-methyl-γ,γ-diphenylthio-, 5181⁷.
- C₁₁H₁₁N₂O₂ Pyruvic acid, (o-nitrophenyl)-, Et ester, β,β-diphenylhydrazone, 4699⁴.
- C₁₁H₁₁N₂O₂ Indoline, 2-amino-1-benzoyl-3,3-dimethyl-, picrate, 3927⁴.
- C₁₁H₁₁N₂O₂ 2(1) - s - Triazone, 4 - (p - dimethylaminophenyl)tetrahydro - 6 - imino-, dipicrate, and its - HCl, 4221^{1,8}.
- C₁₁H₁₁Br₂O₂ 5-Nonanone, 1,9-di-p-anisyl-1,2,3,4,6,7,8,9-octabromo-, 3911⁶.
- C₁₁H₁₁N₂ Indanone, 2-p-methylbenzyl-, phenylhydrazone, 2706⁹.
- C₁₁H₁₁N₂O₂ Glyoxylic acid, (o-benzamido-phenyl)-, salt with phenethylamine, 5186⁴.
- C₁₁H₁₁N₂O₂ Propiophenone, α-dimethylamino-β-phenyl-, picrate, 2117⁴.
- C₁₁H₁₁O Stilbene, α-(p-propoxyphenyl)-, 1794⁷.
- C₁₁H₁₁O Δ^{1,3,5,8} - 5 - Nonatetrene, 1,9-di-p-anisyl-, 3911⁶.
- C₁₁H₁₁O₂ Compd., m. 104°, from rotenone acid, 601⁴.
- C₁₁H₁₁O₂ Isorotenone, 601³, 4472⁴.
- Quinone, 2,6 - di-p-anisyl-3-ethoxy-6-methoxy-, 1127⁶.
- Rotenone, 4472²; and salt, 601³.
- C₁₁H₁₁ClO₂ ε - Heptenic acid, α - acetyl - 5 - (o - chlorophenyl) - δ - keto - β - phenyl-, Et ester, 831².
- C₁₁H₁₁NO Indoline, 2-methoxy-3,3-dimethyl-1,2-diphenyl-, 4699⁴.
- C₁₁H₁₁NO₂ Compd., m. 34.5°, from o-cresol and quinaline, 122².
- Compd., m. 24.5°, from p-cresol and quinaline, 123¹.
- C₁₁H₁₁NO₂ Rotenone, oxime, and - HCl, 601³.
- C₁₁H₁₁NS Isovaleramide, α,α-diphenylthio-, 5181⁷.
- C₁₁H₁₁N₂O₂ Benzoin, 4-(α-methylbenzyl)semicarbazone, 132⁹.
- C₁₁H₁₁N₂O₂ 5 - Isophenothiazine, 9 - dimethylamino - 3 - methylimino, 3 - methylsalicylate, 404¹.
- C₁₁H₁₁N₂O₂ Dehydrobrucinolone, acetate, 3230¹.
- C₁₁H₁₁ClO₂P Phospham, chloroisobutoxy(triphenylmethoxy) (?), 3921⁶.
- Phosphine oxide, chloroisobutoxy(triphenylmethoxy) (?), 3921⁶.
- C₁₁H₁₁N Benzophenone, carvacrylhydrazone, 5470³.
- 2-Butanone, 3-benzyl-4-phenyl-, phenylhydrazone, 3927⁶.
- 2-Propanone, 1,3-diphenyl-, 2,5-xylylhydrazone, 4699⁴.
- C₁₁H₁₁N₂O p - Benzenone, 4 - [bis(dimethylaminophenyl)methylene], 4468⁴.
- C₁₁H₁₁N₂O₂ Citric acid, 5-anilino-1-phenylimino Δ² + 2-pentadienol salt, 2438⁷.
- C₁₁H₁₁N₂O₂ Butaburic acid, 5-ethyl-5-isopropyl-1,3-bis(p-nitrobenzyl)-, 821⁶.
- C₁₁H₁₁O₂ Acid, m. 209°, from rotenone, 4472³.
- Isorotenol, 447^{2,3}.
- Rotenol, 4472³.
- Rotenone, dihydro-, 4472².
- C₁₁H₁₁O Δ¹ - Malonic acid, (α-phenoacetylperonyl)-, di-Et ester, 3210⁸.
- C₁₁H₁₁O₂ Isoflavone, 5-hydroxy-3',4',5',6',7-pentamethoxy-2-methyl-, acetate, 2180³.
- C₁₁H₁₁O₂ Daphnol, tetraacetyl-, 2718⁶.
- C₁₁H₁₁ClN See *Malachite green*.
- C₁₁H₁₁ClO Anthocyan chloride, 2462^{1,3}.
- C₁₁H₁₁NO₂ Rytone, dihydro-, oxime, 4472¹.
- C₁₁H₁₁N₂O Leucine, N-(N-valylglycyl)-, 4232².
- C₁₁H₁₁N₂O₂ Brucinic acid, oxime, 3230¹.
- C₁₁H₁₁O₂P Methanephosphonic acid, triphenyl-, di-Et ester, 3921⁶.
- C₁₁H₁₁ClN Malachite green, amino-, 4468⁴.
- C₁₁H₁₁N₂O₂ Carbinol, bis(p - dimethylaminophenyl)(p-hydroxyphenyl)-, 381².
- Strachnine, ethyl-, 3748⁴, 4493⁹.
- C₁₁H₁₁N₂O₂ (See also *Brucine*)
- Camphoronehydroxylamine, oxime, di-Hz deriv., 4209⁹.
- C₁₁H₁₁O₂ Acid, m. 215°, from rotenone, 4472³.
- C₁₁H₁₁O₂ Caproin, β mono-, disalicylate, 4685⁴.
- C₁₁H₁₁Sn Stannane, benzylbutyldiphenyl-, 118⁶.
- C₁₁H₁₁NO Homolycorine, diacetyl deriv., 4223³.
- o - Veratric acid, 6 - [α - (3,4 - dihydro - 6,7-dimethoxy - 1(2) - isoquinolylidene)ethyl]-, Me ester, 813¹.
- C₁₁H₁₁NO₂ See *Narcine*.
- C₁₁H₁₁N₂O Carbinol, (p-aminophenyl)bis(p-dimethylaminophenyl)-, 384².
- C₁₁H₁₁Br₂O₂ 4-Heptanone, 2,6-di-2,3-cresyl-2,6-dimethyl-, dibromo deriv., 2431⁷.
- C₁₁H₁₁N₂O₂ Alumne, N, N'-carbonylbis[β-phenyl-, di-Et ester, 1613⁹, 2165⁴.

- Vomicinic acid, *N*-methyl-, and -HCl, 3474^a
- C₂₃H₂₅N₂O₃ Glucosidyl *p*-cyanobenzylmethylamide, tetraacetyl-, and -HCl, 4450⁷
- C₂₃H₂₅O₂ 4 - Heptanone, 2,6 - di(2,5 - cresyl)-2,6-dimethyl-, cyclic anhydride, 2431⁷
- C₂₃H₂₅O₄ Malonic acid, benzyl-γ-phenylpropyl, di-Et ester, 2710¹
- C₂₃H₂₅O₁₀ Lactone triacid, m. 193-5°, 151⁸
- C₂₃H₂₅KO₃ 4-Heptanone, 2,6-di-2,3-cresyl-2,6-dimethyl-, K deriv., 2431⁷
- C₂₃H₂₅NO₃ Compd., m. 164°, from lobelinine, and -HCl, 4706⁸
- C₂₃H₂₅NO₄ Acedicon, 3975⁷
- C₂₃H₂₅NaO₃ 4-Heptanone, 2,6-di-2,3-cresyl-2,6-dimethyl-, Na deriv., 2431⁷
- C₂₃H₂₅Cl₂IN₂O Strychnidine, dihydro-, methiodide, compd. with CHCl₃, 3710⁹
- C₂₃H₂₅INO₄ Codeinone, butyryldihydro-, methiodide, P 5474⁹
- C₂₃H₂₅N₂O₂ 4(5)-Indolone, 2,2'-methylenebis[6,7-dihydro-3,6,6-trimethyl-, 2716²
- C₂₃H₂₅N₂O₃ Strychnidine, formylmethoxytetrahydro-, 3711³
- C₂₃H₂₅N₂O₆ 2 - Pyrrolicarboxylic acid, 5,5'-methylenebis[4 - acetyl - 3 - ethyl-, di-Et ester, 2184⁴
- C₂₃H₂₅O₃ 3 - Pentadienone, 1,5-bis(4-propenyl-Δ³-cyclohexenyl)-, 2248⁷, 4942²
- C₂₃H₂₅O₃ Digitaligenin, 843⁹
- 4 - Heptanone, 2,6 - di - 2,3 - cresyl - 2,6-dimethyl, 2431⁷
- C₂₃H₂₅O₄ Olivil, methylethyl-, 5188⁷
- C₂₃H₂₅O₄ Undephanthotriacid, mono-Me ester, 151⁸
- C₂₃H₂₅IN₂O₂ Methiodide, m. 236°, of base m. 213°, 3474⁹
- C₂₃H₂₅Mo₂N₂O₁₀, 2898⁸
- C₂₃H₂₅NO₃ Coclaurine, triethyl-, and salts, 2979²
- C₂₃H₂₅NO₃ Glucosidyl *p*-methylbenzylmethylamide, tetraacetyl-, and -HCl, 4450⁷
- C₂₃H₂₅Br₂N₂O Strychnidine, dihydro-, dimethobromide, 3710⁹
- C₂₃H₂₅Cl₂N₂O Strychnidine, dihydro-, dimethochloride, 3710⁹
- C₂₃H₂₅IN₂O Strychnidine, dihydro-, dimethiodide, 3710⁹
- C₂₃H₂₅N₂ Aniline, *p*, *p'*-(3-methylcyclohexylidene)bis[*N*, *N*-dimethyl-, 4688⁸
- C₂₃H₂₅N₂O₂ Strychnidinyl, methoxymethyltetrahydro-, and -HCl, 3710⁹, 3711^{2,3}
- C₂₃H₂₅N₂O₃S Strychnidine, dihydro-, methosulfate, 3710⁹
- C₂₃H₂₅N₂O₃S Piperazine, 1-*p*-tolylsulfonfyl-, C₂ addn. compd., 2183²
- C₂₃H₂₅N₂O₃S Piperazine, 1-*p*-tolylsulfonfyl-, C₁ addn. compd., 2183²
- C₂₃H₂₅O₂ Dianhydrodihydrogitoxygenin, 152²
- C₂₃H₂₅O₂ Gitoxygenon, 149²
- Isodigitoxigenic acid, 149²
- Sarmentogenone, 2981⁹
- C₂₃H₂₅O₂ Duodephanthondiacid, di-Me ester, 151⁸
- C₂₃H₂₅O₁₁ Δ² - Cyclohexadieneacetic acid, 1,2,3,6 - tetraacetoxy - 5 - methoxy-, penta-Et ester, 375⁴
- C₂₃H₂₅O₁₄ Anhydroglucose, tetraacetylglucosidomonosacetone, 108⁴
- ψ-Cellobial α-methylactohide, pentaacetyl, 367⁹
- C₂₃H₂₅NO₂ Duodephanthondiacid, tri-Me ester, oxime, 151⁸
- C₂₃H₂₅NO₁₂ Trimethylphenylammonium tetraacetyl - β - d - glucosido - 1 - sulfate, 3905⁹
- C₂₃H₂₅IN₂: Aniline, *p*, *p'*-cyclopentylidenebis[*N*, *N*-dimethyl-, dimethiodide, 4688⁸
- C₂₃H₂₅O₃ Dianhydrogitoxygenone, tetrahydro-, 152²
- C₂₃H₂₅O₄ Digitoxigenin, 149²
- Isodigitoxigenin, 149²
- C₂₃H₂₅O₄ (See also *Periplogenin*.)
- Digitaligenin, 151⁸
- Gitoxygenin, 149², 151⁸, 4224⁹
- Isodigitoxigenic acid, 149²
- Isogitoxygenin, 149², 4224⁹
- Isosarmentogenin, 2981⁹
- Sarmentogenin, 2981⁹
- C₂₃H₂₅O₄ Acid, m. 278°, from reduction product of digitaligenin, 152²
- Acid, m. 288°, from tetrahydrodianhydrogitoxygenone, 152²
- Isosarmentogenenic acid, 2982²
- C₂₃H₂₅N₂O₆ Leucine, *N*-(*N*-(*N*-phenylethylamylglycyl)leucyl)glycyl-, 4233⁹
- C₂₃H₂₅N₂O₄ Butyric acid, β-(*N*-(*N*-phenylethylamylleucyl)leucylamino), 1389¹
- C₂₃H₂₅N₂O₄ Dodecylamine, μ-Δ²-cyclopentenyl-, picrate, 115¹
- C₂₃H₂₅O₂ Lactone, m. 173°, from tetrahydrodianhydrogitoxygenone, 152²
- C₂₃H₂₅O₃ Dianhydrodihydrogitoxygenin, tetrahydro-, 152²
- C₂₃H₂₅O₃ Gitoxygenin, dihydro-, 149², 152²
- Isodigitoxigenenic acid, 149²
- Periplogenin, dihydro-, 151⁸
- Sarmentogenin, dihydro-, 2981⁹
- C₂₃H₂₅N₂O₃ Isogitoxygenenic acid, 119²
- C₂₃H₂₅O₂ Benzaldehyde, *p*-cyclo-, 1397¹
- C₂₃H₂₅O₄ Compd. from *Cingula biloba* L., 1931¹
- Malonic acid, hydruocarpyl, di-Et ester, 2947²
- C₂₃H₂₅Br₂N₂O *N* - Phenylethylamylmethylamylammonium bromide, 3923³
- C₂₃H₂₅N₂O₂ Imidazole, 2,4,5-tricyclohexyl-, hydro-, acetate, 389¹
- C₂₃H₂₅O₂ Erucic acid, Me ester, 2422⁴
- C₂₃H₂₅O₄ Heacosanoic acid, α-hydroxy-, acetate, 3664⁸
- Malonic acid, amylhendecyl-, di-Et ester, 2421²
- butyldodecyl-, di-Et ester, 2421²
- sec-butylododecyl-, di-Et ester, 2421²
- decylhexyl-, di-Et ester, 2421²
- dioctyl-, di-Et ester, 2421²
- dodecylisobutyl-, di-Et ester, 2421²
- ethyltetradecyl-, di-Et ester, 2421²
- hendecyl-α-methylbutyl-, di-Et ester, 2421²
- heptylnonyl-, di-Et ester, 2421²
- isopropyltridecyl-, di-Et ester, 2421²
- methylpentadecyl-, di-Et ester, 2421²
- propyltridecyl-, di-Et ester, 2421²
- C₂₃H₂₅O₁₂ Convallamarin, 2501⁴
- C₂₃H₂₅O₂ Tricosanoic acid, 556²
- C₂₃H₂₅ Tricosane, 4438⁸
- C₂₃Co₂K₂N₂O₂₄ + 24H₂O, 4904⁹
- C₂₃Co₂K₂N₂O₂₄ + 8H₂O, 4904⁹
- C₂₃Cr₂K₂N₂O₂₄ + 40H₂O, 4904⁹
- C₂₃Fe₂K₂N₂O₂₄ + 24H₂O, 4904⁹
- C₂₃H₂₅O₂ Dibenzo[*ba*]phenanthrene 2,10-dicarboxylic acid, 5,8,13,14-tetrahydro-, 5,8,13,14-tetraketo-, 3915⁹
- C₂₃H₂₅N₂O₂ Compd. from reduction product of 3,4,9,10-tetranitropropylene and COCl₂, 2436²

- C₂₁H₁₉O₂** Dibenzopyrene-1,2-dione, P 715¹
C₂₁H₁₉O₄ 3,4,8,9-Dibenzopyrene-7,14-dione, 6,13-dihydroxy, P 3480²
C₂₁H₁₉ClO₂ Naphthalfluorescein, 3-chloro, 2435³
C₂₁H₁₉NO₄ 5,6- β -Naphthoquinoline-1-carboxylic acid, 7,12-diketo-3-phenyl, and *derivs.*, 3707^{1,2,3}
C₂₁H₁₉NO₇ 2-Anthraquinonecarboxylic acid, 3-hydroxy-4-phthalimidomethyl-, 2173³
C₂₁H₁₉BrNO₂ Phthalimide, N-[4-(*p*-bromophenylazo)-1-naphthyl], 3459⁴
C₂₁H₁₉Cl₂O₂ Perylene, 3,9-diacetyl-4,10-di-chloro-, 1130¹
C₂₁H₁₉N₂O₂ [$\Delta^1\Delta^2(2'3')$ Bi- α -naphthazolyl] 2,2'-dione, 4949⁵
 Dinaphtho[1,2,3-*de*, 3,3',1- α]phthalazine 5,8-dione, 2,10-dimethyl, 3915⁶
C₂₁H₁₉N₂O₃ [$\Delta^1\Delta^2(2'3')$ Bi- α -naphthazolyl] 2,2'-disulfone acid, 2,2'-diketo, 4949⁵
C₂₁H₁₉O₄ Dibenzo[*gk*]phenanthrene 5,8,13,14-tetrone, 2,10-dimethyl, 3915⁶
 Dibenzo[*gk*]pyrene 6,12-dione, dimethoxy, P 1758¹
C₂₁H₁₉NO₂ 5,6- β -Naphthoquinoline-1-carboxylic acid, 3-phenyl, and *Na salt*, 3707¹
C₂₁H₁₉NO₄ Anthraquinone, hydroxymethylphthalimidomethyl-, 2173³
C₂₁H₁₉N₂O Phthalimide, N-(4-phenylazo-1-naphthyl)-, 3459⁴
C₂₁H₁₉N₂O₂ 1,2-Benzanthren-5-ol, 6-*p*-nitrophenylazo, 5472³
C₂₁H₁₉N₂O₃ Benzenesulfonic acid, *p*-4-phthalimido-1-naphthylazo, *K salt*, 3459⁴
C₂₁H₁₉ Tetraphenylene, 129¹
C₂₁H₁₉AgCl₂N₂O₆ Compd. of phenanthroline and silver chlorate, 353¹
C₂₁H₁₉AgCl₂N₂O₄ Compd. of phenanthroline and silver perchlorate, 353¹
C₂₁H₁₉Ag₂N₂O₈S₂ Compd. of phenanthroline and silver persulfate, 353¹
C₂₁H₁₉Cl₂N₂O₂ Perylene, 3,9-diacetamido-4,10-dichloro-, 4212¹
 Perylenediamine, bis(chloroacetyl)-, 2436²
C₂₁H₁₉N₂O₂ Indophthalcin, 1635³
 Naphthalimide, N-[*p*-(*p*-aminophenyl)phenyl], 127¹
 α -Tolonic acid, α -3-indyl- α ,3-pseudonolylidene, and *derivs.*, 1635³
C₂₁H₁₉N₂ Compd. from tetranitroethylene, 2436²
C₂₁H₁₉OS 7-*meso*-Benzanthrenone, *p*-tolylmercapto-, P 4710²
C₂₁H₁₉O₂ Naphthalene, dibenzoyl-, P 1137¹
 Perylene, 3,9-diacetyl-, 1351²
C₂₁H₁₉O₃ 1,5-Naphthylenedimercaptan, di-benzoate, 1634¹
C₂₁H₁₉O₃ Dibenzo[*gk*]phenanthrene-1,2-trione, dimethyl-, 3915⁶
C₂₁H₁₉O₄ 2,3-Naphthalenediol, dibenzoate 2435³
 2,6-Naphthalenediol, 1,5-dibenzoyl, 832²
C₂₁H₁₉O₅ 8,13- $\beta\beta\beta\alpha$ -Dinaphthofurandioldiacetate, 833²
C₂₁H₁₉O₆ 1,4-Naphthoquinone, 2-hydroxy-3-(2-hydroxy-1-naphthyl)-, 833²
C₂₁H₁₉O₇ Alizarin, 3-methoxy-, acetate benzoate 4697²
- C₂₁H₁₉N₃** Compd., m 228°, from 2-(*o*-benzamidobenzyl)-4,6-diphenylpyridine, 1641^{1,2}
C₂₁H₁₉N₃O₂ Phthalamic acid, N-(4-phenylazo-1-naphthyl)-, and *salts*, 3459⁴
C₂₁H₁₉ Dibenzo[*gk*]phenanthrene, 2,10-(and 2,11)-dimethyl-, 3915⁶
C₂₁H₁₉AsBr Arsenic, bromobis(phenylphenyl)-, 2955²
C₂₁H₁₉AsCl Arsenic, chlorobis(phenylphenyl)-, 2955²
C₂₁H₁₉AsI Arsenic, iodobis(phenylphenyl)-, 2955²
C₂₁H₁₉Br₂O₄ Fluorescein, dibromodimethyl-, 3458²
C₂₁H₁₉HgO₈ Fluorescein, diethyl, Hg deriv., 3458²
C₂₁H₁₉N₂O 2-Naphthol, 1-[α,β -bis(phenyl-imino)ethyl]-, 2951¹
C₂₁H₁₉N₂O Perylenediamine, diacetyl-, 2436²
C₂₁H₁₉O Ketone, 8-benzyl-1-naphthyl phenyl-, 3923³
C₂₁H₁₉O₂ 1-Anthracic acid, 10-(5-carboxy-*o*-anisyl)-9,10-dihydro-9-keto-4-methoxy-, 1896²
C₂₁H₁₉ClO₃ 1-Naphthalenesulfonyl chloride, 1,8-dibenzyl-, 3923³
C₂₁H₁₉NO 2-Naphthol, 1-(α -benzalanunobenzyl)-, 2172¹
C₂₁H₁₉NO₂ 1,2-Benzanthren-5-ol, 6-(diacetylamino)-, acetate, 5472³
C₂₁H₁₉NO Anthraquinone, 4-(aminomethyl)-1-hydroxy-2-methyl-, 2174²
C₂₁H₁₉N₂O₄ 4-Pyrazolecarboxylic acid, 3-(nitrophenyl)-1,5-diphenyl, Et ester, 3469², 3470²
C₂₁H₁₉ Naphthalene, dibenzyl-, 3220¹
C₂₁H₁₉As₂O Arsenic, diphenyl-, oxide, 2955²
C₂₁H₁₉BrP + 2H₂O Tetraphenylphosphonium bromide, 2158²
C₂₁H₁₉CIN 1-Triphenylmethylpyridinium chloride, 3220¹
C₂₁H₁₉Cr Chromium tetraphenyl, 787¹
C₂₁H₁₉HgI₂ Diphenylthodonium iodide, HgI₂ salt, 3214¹
C₂₁H₁₉N₂ Benzidine, diphenyl-, 5043¹
 Pyridine, 2-(α -aminobenzyl)-4- β -diphenyl-, and -HCl, 1640¹, 1641¹
 -, 2-methyl-1,6-diphenyl-1-phenyl-imino-, 1640¹
C₂₁H₁₉N₂O $\Delta^1-\Delta^2$ -Isoxazolinemfrole, 2-ethyl-3,4,5-triphenyl-, 142²
 Propionitrile, α -(β -benzoyl- α,β -diphenylvinylamino)-, 142²
C₂₁H₁₉N₂O₂ 2,3-Anthraquinonecamphorquinoxaline, 2170¹
 1,1'-Bi[2-naphthylamine], N,N'-diacetyl-, 3698²
 4-Pyrazolecarboxylic acid, 1,3,5-triphenyl-, Et ester, 3469²
C₂₁H₁₉N₂O₃ 4-Thiazolidone, 3-phenyl-2-phenylimino-5-veratral-, 821¹
C₂₁H₁₉N₂O₄ See *Diphenylamine blue*
C₂₁H₁₉N₂O Acetophenone, *p*-(2-hydroxy-1-naphthylazo)-, phenylhydrazone, 3461¹
 Scarlet R, 3542¹
C₂₁H₁₉N₂O₂ Benzaldehyde, *o*-(β -cyano-3,4-dimethoxy-2-nitrostyryl)-, phenylhydrazone, 5186²
C₂₁H₁₉N₂O₃ Naphthalenesulfonic acid, (acetamidophenylazo)anilino-, 1837²
C₂₁H₁₉O Compd., m. 165-6.5°, from MeCOPh and CaH₂, 139²
C₂₁H₁₉O₂ Isobutyric acid, β -1-naphthyl β' -2-naphthyl-, 2707²

- Spiro[1,2 - benzopyran - 2,3' - 4,3 - β -naphthopyran], 2'-isopropyl-, 3705⁴.
- C₂₁H₂₀O₄Si Silicane, tetraphenoxy-, 4457³.
- C₂₁H₂₀O₄ Fluorescein, diethyl-, 3458⁴.
- C₂₁H₂₀O₄ Benzoic acid, glyceryl ester, 3938⁴.
Homogentisic acid, Et ester, dibenzoate, 2708¹.
- C₂₁H₂₀O₄ Flavone, 4'-benzyloxy-3,5,7-trihydroxy-3',5'-dimethoxy-, 2181¹.
Quinone, 2,5-bis(*p*-hydroxyphenyl)-3,6-dimethoxy-, diacetate, 1127².
o-Toluic acid, α , α -bis(5-carboxy-*o*-anisyl)-, 1896¹.
- C₂₁H₂₀Si Silicane, tetraphenyl-, 2954⁴, 3661⁷.
- C₂₁H₂₀Sn Stannane, tetraphenyl-, 3447⁴.
- C₂₁H₂₀Bi Bismuthine, tristyryl-, 118⁹.
- C₂₁H₂₀ClO₄ 1,4-Pyrone, 2-methyl-6-phenyl-, perchlorate, 143¹.
- C₂₁H₂₀NO 1 - Naphthalenecarbinol, α -(α -amino-benzyl)- α -phenyl-, 4693³.
- C₂₁H₂₀NO₂S 1 - Naphthalenesulfonamide, 4,5-dibenzyl-, 3923⁷.
- C₂₁H₂₀NO₂ Fluoran, 6-dimethylamino-1,3-dimethyl-, 1122³.
2-Indolinol, 1-benzoyl-3,3-dimethyl-, benzoate, 3927⁴.
1,2 - Pyran - 2,4(3) - dione, 6 - benzyl - 3,5-diphenyl-, compd. with NH₃, 2439⁷.
- C₂₁H₂₀N₂O Aniline, *N*-(ϵ -*p*-anisyl- Δ^1 -4-pentadienylidene) - *p*-phenylazo-, 3912¹.
- C₂₁H₂₀N₂O₂S₂ 1-Phenol-2,4,6-trisulfonanilide, 1630³.
- C₂₁H₂₀N₄O₂ Benzenhexamine, tripicrate, 2428⁴.
- C₂₁H₂₀As₂N₄ Arsenobenzene, 3,3'-diamino-4,4'-dianilino-, 2954⁴.
- C₂₁H₂₀N₂ Phthalatine, 1,4-di-2,5-xylyl-, 3915⁴.
Pyrazole, 1 - benzyl - 4 - ethyl - 3,5 - diphenyl-, 4701².
- C₂₁H₂₀N₂O₂ Cinnamic acid, *p*-ethoxy-, *p*-(*p*-anisylazo)phenyl ester, 1396⁴.
- C₂₁H₂₀N₂O₂ Glutaric acid, β -benzoyl- α , γ -dicyano- β -phenyl(-), di Et ester, 2946³.
- C₂₁H₂₀N₂O₂ 2,5 - Piperazinedione, 3,6 - bis(4-hydroxy - 3 - methoxybenzyl)-, diacetate, 5469¹.
- C₂₁H₂₀O Isobenzofuran, 1,2- δ -2,5-xylyl-, 3915⁴.
- C₂₁H₂₀O₂ Benzene, dixylyl-, 39⁴ 5¹.
- C₂₁H₂₀O₂ Perylenediol, hexahydro-, diacetate, 3223⁴.
Phenolphthalein, 2',2'',5',5''-tetramethyl-, 2128³.
Phthalide, 2,2-bis(5-methyl-*o*-anisyl)-, 1896¹.
- C₂₁H₂₀O₂ Homopterocarpin, benzoyldihydro-, 2246⁴.
- C₂₁H₂₀O₂ Flavone, 3,5,7-trihydroxy-3',4',5'-trimethoxy-, triacetate, 2181¹.
- C₂₁H₂₀Br₂N₂S₂ 2 - Allyl - 1 - { γ - (2 - allyl - 1(2)-benzothiazylidene) - β - methylpropenyl}-benzothiazolium bromide, 1903³.
- C₂₁H₂₀Cr₂N₂O₂, 2116⁹.
- C₂₁H₂₀N Indole, 2-benzyl-1,4,7-trimethyl-3-phenyl-, 4699⁷.
- C₂₁H₂₀NO Acrylophenone, β -isopropylamino- α , β -diphenyl-, 142³.
 Δ^1 - 3 - Butenone, 4 - (β - dimethylamino-phenyl)-1,3-diphenyl-, 5176³.
- C₂₁H₂₀N₂O Acrylophenone, β -(α -methoxyethyl-amino)- α , β -diphenyl-, 142³.
 Δ^1 - Isoxazoline, 2 - ethyl-5-methoxy - 3,4,5-triphenyl-, 142³.
- Δ^1 - 1 - Propenol, 1-*N* - methylanilino - 3,3-diphenyl-, acetate, 2697⁴.
- C₂₁H₂₀N₂O₂ 1 - Indanone, 2 - (γ - phenylpropyl)-, *p*-nitrophenylhydrazone, 2710¹.
- C₂₁H₂₀Cl₂CoHgN₄, 1363¹.
- C₂₁H₂₀N₂O₂ Naphthalimide, *N*-(*N*-hexylanilino)-, 4214¹.
- C₂₁H₂₀N₂O₂ Phthalimide, *N*, *N*'-octamethylene-bis-, 2419⁴.
- C₂₁H₂₀N₂O₂S 1 - Benzylpyridinium sulfate, 3905⁹.
- C₂₁H₂₀N₂O₂S₂ [4,4' - Bi - Δ^1 - pyrazoline] - 1,1' dicarboxy - *p* - toluidine, 5,5' - diketo - 3,3' - dimethylidithio-, 388².
- C₂₁H₂₀O Stilbene, α - (*p* - butoxyphenyl) -, 1794⁴.
- C₂₁H₂₀O₂ 1,4 - Cyclohexanediol, dicinnamate, 4677¹.
o-Toluic acid, α , α -bis(5-methyl-*o*-anisyl)-, 1896¹.
- C₂₁H₂₀O₂ Compd. from di-Me *m*-benzenediacetate and Na, 137⁹.
Compd., bi 226-8°, di-Me *p*-benzenediacetate and Na, 137⁹.
- C₂₁H₂₀S₂ Formic acid, dithio-, benzyl ester, trimer, 3439¹.
- C₂₁H₂₀N Compd., bi 200-5°, from cyclohexanone and *p*-cyclohexylaniline, 4688³.
- C₂₁H₂₀N₂O Peronine, 2160⁴.
- C₂₁H₂₀N₂O Benzophenone, 4-carvacrylsennecarbazone, 5470².
- C₂₁H₂₀N₂O₂ Aniline, *p*, *p*' - (*p* - nitrostyrylidene)-bis[*N*, *N*-dimethyl-, 3919⁴].
- C₂₁H₂₀N₂O₂S 3-Isophenothiazine, ρ -dimethylamino - 3 - methylimino-, 3 - methyl toluate, 404³.
- C₂₁H₂₀N₂O₂ Trinitro deriv., m. 180-4°, of hydrocarbon from 4-methyl-4-phenyl 2 pentanone, 4461¹.
- C₂₁H₂₀Cl₂N₂O₂ 2,5 - Piperazinedione, 1,4 - di-methyl-, compd. with β -trichloroethyl carbanilate, 140⁹.
- C₂₁H₂₀CuO₂ Acetoacetic acid, γ -phenoxy-, Et ester, Cu deriv., 4481¹.
- C₂₁H₂₀N₂ Aniline, styrylidenebis[*dimethyl* -, 715⁴].
- C₂₁H₂₀N₂O₂ α -Toluamidine, *N*, *N*'-di *p* phenetyl-, 2245⁴.
- C₂₁H₂₀N₂O₂ Barbituric acid, 5-butyl-5-ethyl 1,3-bis(*p*-nitrobenzyl)-, 821¹.
- C₂₁H₂₀O₂ Benzene, 1,4-di-*p*-anisyl-2,3,5,6-tetra-methoxy-, 1127².
- C₂₁H₂₀O₂ Glucose, monoacetone-3-methyl-, di-benzoate, 107³.
- C₂₁H₂₀O₂ Compd., m. 185-6°, from NaOH and, 5,6,7 - trimethoxysisocoumarin, 3699⁴.
- C₂₁H₂₀O₂ Iridin, 1883⁹.
Scopoletin, tetraacetoglucoiside, 600⁴.
- C₂₁H₂₀O₂ Bergein, pentaacetate, 3699⁴.
- C₂₁H₂₀Br₂N₂O₂ Alanine, *N*-[*N*-[*N*-(α -bromohydrocinnamyl) glycy]glycylglycyl-, 2992⁴.
- C₂₁H₂₀N₂O₂ Protocatechuyl alcohol, α (vanillylaminomethyl) - 3,4,4' - triacetate, oxalate, 5162³.
- C₂₁H₂₀N₂O₂S *s* - Triazine, 2,4,6 - tris(acetonylmercapto)-, bis(phenylhydrazone), 102¹.
- C₂₁H₂₀ Hydrocarbon, bi 195°, from 4-methyl-4-phenyl-2-pentanone, 4461¹.
- C₂₁H₂₀N₂ Aniline, *p*, *p*' - (α - methylbenzyl)-bis[*N*, *N*-dimethyl-, 4689¹].
Compd., bi 270-80°, from cyclohexanone and 1-naphthylamine, 4683¹.

- $C_{24}H_{31}N_4O_2$ 2, 5 - Pyraanmedicarbonyxylyde, 2, 6 dihydro-3, 6-dimethyl-, 835¹.
 Quinoline, cyclohexyldenebis[1, 2, 3, 4-tetrahydro-1-nitroso-, 4688¹.
 $C_{24}H_{31}N_4O_6$ 2, 3-Butanediamine, dipicronate, 3663¹.
 $C_{24}H_{31}O_2$ Δ^1 - 3 - Hexenone, 1 β phenyl-, di-meride, 3896¹.
 $C_{24}H_{31}O_2$ Isonorbixin, 4480¹.
 Norbixin, 4480¹.
 $C_{24}H_{31}O_2$ Compd., m. 225-6°, from Et β -veratryl- β -hydroxybutyrate, 842¹.
 $C_{24}H_{31}NO_2$ Homonarceine, 4534¹.
 $C_{24}H_{31}N_2O_8$ Propionic acid, α -selenocyanate, quinine salt, 2154¹.
 $C_{24}H_{31}N_4O_2$ Alanine, N-[N-[N-(N-phenyl-alanylglycyl)glycyl]glycyl]-, 2902¹.
 $C_{24}H_{31}$ Biphenyl, dicyclohexyl-, 4936¹.
 $C_{24}H_{31}N_2$ Quinoline, cyclohexyldenebis[1, 2, 3, 4-tetrahydro-, 4688¹.
 $C_{24}H_{31}N_2O_2$ Acetanilide, p, p'-cyclohexyldenebis-[N-methyl-, 4687¹.
 $C_{24}H_{31}N_2O_8$ Spiro[thioxane - 2, 9' - xanthen]-6-one, 3', 6' - bis(diethylamino), 1899¹.
 $C_{24}H_{31}N_2O_2$ Vomisinic acid, betaine, 3474¹.
 $C_{24}H_{31}N_2O_8$ Vomisinic acid, dimethyl sulfate addn. compd., 3474¹.
 $C_{24}H_{31}N_4O_8$ 4(3) Pyrimidone, 6 - [p, p' - bis-(dimethylamino)benzohydryl] 2 - (ethylmercapto) - 5 - methyl-, 2445¹.
 $C_{24}H_{31}N_4O_2$ Tyrosine, N-[N-(N-phenylcarbamyl-leucyl)glycyl]-, 4233¹.
 $C_{24}H_{31}O_2$ Bufotalien, 1413¹.
 $C_{24}H_{31}O_2$ Malonic acid, phenethyl-phenylpropyl-, di-Et ester, 2934¹.
 Norbixin, dihydro-, 4480¹.
 $C_{24}H_{31}As_2O$ Arsinic, cyclohexylphenyl-, oxide, 120¹.
 $C_{24}H_{31}Br_2O_{11}$ Gentiobiose, acetodibromo-, 1061¹.
 $C_{24}H_{31}N_2O$ Pseudostrychnidine, methyl-, dimethiodide, 3711¹.
 $C_{24}H_{31}N_2O_2$ 4, 4'-Bipiperidine, 1, 1'-bis(p, α -dihydroxybenzyl)-, 4703¹.
 $C_{24}H_{31}N_4O_2$ 2, 5 - Piperazine, 1, 4 - dimethyl-, compd. with Et carbamate, 140¹.
 $C_{24}H_{31}N_4O_2$ Galactose, 6- β -galactosido-, phenyl-osazone, 107¹.
 $C_{24}H_{31}O_2$ Asaresene A, 5010¹.
 $C_{24}H_{31}O_2$ Olivil, diethyl-, 5188¹.
 $C_{24}H_{31}O_2$ Alcohol from soy bean, 1933¹.
 $C_{24}H_{31}O_2$ Undephantbontriacid, di-Me ester, 151¹.
 $C_{24}H_{31}O_{11}$ Cellobiosene, hexaacetyl-, 1622¹.
 $C_{24}H_{31}O_2$ Dextrinosan, hexaacetate, 4676¹.
 $C_{24}H_{31}O_2$ Tetragalacturonic acid, 1623¹.
 $C_{24}H_{31}BrO_{11}$ Gentiobiose 8'-bromohydrin, β -hexaacetyl-, 1061¹.
 $C_{24}H_{31}NO_2$ Phenethylamine, ethoxy - 2 - (p-ethoxystyryl) - N - ethylmethoxy - Δ - methyl-, and chloroplatinate, 2970¹.
 $C_{24}H_{31}Br_2O_{11}$ Chaulmoogric acid, 2, 4-dibromophenyl ester, 3540¹.
 $C_{24}H_{31}ClNO_2$ Coclaurine, triethyl-, metho-chloride, chloroplatinate, 2970¹.
 $C_{24}H_{31}Cl_2O_2$ Chaulmoogric acid, 2, 4-dichlorophenyl ester, 3540¹.
 $C_{24}H_{31}N_2$ Aniline, N, N-diethyl-N', N'-dimethyl - p, p' - cyclohexyldenebis-, and -HCl, 4688¹.
 $C_{24}H_{31}N_2O_2$ See *Eucypine*.
 $C_{24}H_{31}N_2O_2$ Nitrohydroxamic acid from de-hydrocholic acid trioxime, 2985¹, 4482¹.
 $C_{24}H_{31}O_2$ See *Dehydrocholic acid*.
 $C_{24}H_{31}O_2$ Bithamic acid, 4482¹.
 $C_{24}H_{31}O_{11}$ Glucoside, tetraacetylhydroxy-, 4208¹.
 $C_{24}H_{31}BrN_2O_2$ Strychnidine, methoxymethyl-tetrahydro-, methobromide, 3710¹.
 $C_{24}H_{31}ClN_2O_2$ Strychnidine, methoxymethyl-tetrahydro-, methochloride, 3711¹.
 $C_{24}H_{31}ClN_2O_2$ 5 - Benzoyl - 2, 3, 6 - trimethyl-glucosidotrimethylammonium chloride, C₂₄H₃₁N HCl addn. compd., 1116¹.
 $C_{24}H_{31}N_2O$ Strychnidine, methoxymethyl-tetrahydro-, methiodide, 3711¹.
 $C_{24}H_{31}NO_2$ Hydroxamic acid, decomp., 225°, from dehydrocholic acid trioxime, 4482¹.
 $C_{24}H_{31}NO_{11}$ Glucoside, tetraacetylhydroxy-, oxime, 4208¹.
 $C_{24}H_{31}N_2O_2$ Sarmentogenone, semcarbazono, 2984¹.
 $C_{24}H_{31}Ga_2O_{10}$ + 5H₂O, 5425¹.
 $C_{24}H_{31}HgN$ Amine, p, p' - mercuribis[N, N-dipropyl-, 1889¹.
 $C_{24}H_{31}N_2$ Amine, p, p' - cyclohexyldenebis-[N, N - dimethyl-, dimethiodide, 4688¹.
 $C_{24}H_{31}N_2O_2$ Benzyl alcohol, α -(α -ethylaminoethyl)-, oxalate, 4205¹.
 Ephedrine, Δ -methyl-, oxalate, 1472¹.
 $C_{24}H_{31}N_2O_2$ Oxaminohydroxamic acid, decomp., 224-6°, from dehydrocholic acid trioxime, 4482¹.
 $C_{24}H_{31}N_2$ Guanidine, decamethylencis[phenyl-, p 5197¹.
 $C_{24}H_{31}O_2$ 2-Norcamphanealdehyde, trimer, 3692¹.
 Resorcinol, chaulmoogryl-, 2946¹, 2947¹.
 $C_{24}H_{31}O_2$ Acid from wood of *Pentapodon mollis*, 2201¹.
 Bufodesoxycholic acid, 1646¹.
 $C_{24}H_{31}O_2$ Isopropiogenic acid, Me ester, 151¹.
 Isosarmentogenone acid, Me ester, 2982¹.
 $C_{24}H_{31}O_2$ Th 2, 4-hexanedione, Th deriv., p 606¹.
 $C_{24}H_{31}O_{10}$ Galactoside, (1-tetraacetyl β -D-borulyl-*, 5167¹.
 $C_{24}H_{31}NO_2$ Chaulmoogranilide, hydroxy, 4678¹.
 $C_{24}H_{31}NO_2$ Resorcinol, chaulmoogryl-, oxime, 2947¹.
 $C_{24}H_{31}NO_2$ Desoxybithamic acid, oxime, 1906¹, 2985¹.
 Isodesoxybithamic acid, oxime, 1906¹.
 Pyrodesoxyaconine, demethyl-, 2243¹.
 $C_{24}H_{31}N_2O_2$ Dehydrocholic acid, trioxime, 1646¹, 2985¹.
 $C_{24}H_{31}INO_2$ 2 - (Carboxymethyl) - 1, 2, 3, 4-tetrahydro - 2 - isopropylisouquinolinium iodide ester with menthol, 1643¹.
 $C_{24}H_{31}IN_2$ Aniline, p, p' - (α -methylamylidene)-bis[N, N-dimethyl-, dimethiodide, 4688¹.
 $C_{24}H_{31}N_2O_2$ Cholamic acid, diketo-, dioxime, 4482¹.
 $C_{24}H_{31}N_2O_2$ 2 - (Carboxymethyl) - 1, 2, 3, 4-tetrahydro - 2 - isopropylisouquinolinium nitrate, ester with menthol, 1642¹.
 $C_{24}H_{31}O_2$ Resorcinol, 4-(p- Δ^2 -cyclopentenyltri-decyl)-, 2947¹.
 $C_{24}H_{31}O_2$ Resorcinol, dihydrochaulmoogryl-, 2946¹.
 $C_{24}H_{31}O_2$ Apocholic acid, 1906¹, 4927¹.
 $C_{24}H_{31}O_2$ Isodigitoxigenic acid, Me ester, 149¹.
 $C_{24}H_{31}O_{10}$ Galactoside, (1-tetraacetyl β -D-menthyl-, 5167¹.
 $C_{24}H_{31}O_{11}$ Galactose, diacetomannosidodia-cetone-, 107¹.

- Mannose, diacetone-mannosidodiacetone-, 1079.
- C₂₁H₃₁O₁₂ Mucic acid, di-Am ester, tetraacetate, 4193⁹.
- C₂₁H₃₁NO₂ Resorcinol, dihydrochaulmoogryl-, oxime, 2946⁹.
- C₂₁H₃₁NO₂ Dinicotinic acid, 2,6-dimethyl-4-pentadecyl-, and *derivs.*, 19024.
- C₂₁H₃₁NO₂ Glycine, leucyloctaglycyl-, 2730⁹.
- C₂₁H₃₁O₂ Bufocholanic acid, 1646⁹.
- Resorcinol, 4-(*p*-cyclopentyltridecyl)-, 2947².
- C₂₁H₃₁O₂ Stearophenone, 3,4-dihydroxy-, 2611².
- C₂₁H₃₁O₂ (See also *Desoxycholic acid*)
- Hydrosxycholic acid, 4296⁹.
- C₂₁H₃₁O₂ See *Cholic acid*
- C₂₁H₃₁O₂ Adonidin, 933⁹, 2501⁴.
- C₂₁H₃₁O₂ Galactose, cellobiosidodiacetone-, 1074.
- Galactose, lactosidodiacetone-, 1074.
- C₂₁H₃₁O₂ Tetraglucosan, P 1652¹.
- C₂₁H₃₁O₂ Succinic acid, dimethyl ester, 474³.
- C₂₁H₃₁As₂O₂ Arsine, dicyclohexyl-, oxide, 120⁹.
- C₂₁H₃₁N₂ Compd. from 4-(*p*-chloroethyl)cyclohexylamine, 2715⁴.
- C₂₁H₃₁Cl₂N₂Sn, 2896².
- C₂₁H₃₁Mo₂N₂O₂S₂, 2899⁴.
- C₂₁H₃₁N₂O₂ Norbixindiamide, perhydro-, 4480⁹.
- C₂₁H₃₁O₂ 2 - Eicosanone, 6,10,14,18 - tetramethyl-(?), 3702⁹.
- C₂₁H₃₁O₂ See *Lignoceric acid*
- C₂₁H₃₁NO₂ Triethylamine, trihydroxy-, oleate, 3769⁹.
- C₂₁H₃₁ Tetracosane, 4438².
- C₂₁H₃₁N Docosylamine, *N,N*-dimethyl-, and -HCl, 4668⁹.
- C₂₁H₃₁Br₂N₂O₂Pt₂, 5428⁴.
- C₂₁H₃₁Cl₂N₂O₂Pt₂, 5428⁴.
- C₂₁H₃₁Cl₂N₂O₂Pt₂, 5428⁴.
- C₂₁H₃₁NO₂ 7 - *meso* - Benzanthrene, 3,4 - dicarboximide, 7-keto-*N*-phenyl-, P 715².
- C₂₁H₃₁N₂O₂ Anthrapyrazolone, (carboxynaphthyl)-, P 2044⁴.
- C₂₁H₃₁N₂O₂ Quinolone, 2,4 - bis(2,4 - dinitrostyryl)-, 4682⁹.
- C₂₁H₃₁O₂ Spiro[4.5] - *β* - naphthopyran - 3,9' - zanthene], 3705⁹.
- C₂₁H₃₁O₂ Anthragallol, diacetate, benzoate, 4697².
- C₂₁H₃₁NO₂ 5,6 - *β* - Naphthoquinone - 1-carboxylic acid, 3-phenyl-, Me ester, 3707¹.
- C₂₁H₃₁NO₂ Phthalimide, *N*-(4-tolylazo-1-naphthyl)-, 3459⁹.
- C₂₁H₃₁N₂O₂ 1,3,6 - Heptatriazine, 1-carbethoxyammonaphthyl-4,5 - naphthylene 2,7-endoxy-, 2953⁴.
- Sallylic acid, 3,5-bis(phenylazo)-, Ph ester, 4203⁹.
- C₂₁H₃₁O₂ 2 - Acrylonaphthone, *β,β* - diphenyl-, 4187².
- Acrylophenone, *β* - 1 - naphthyl - *β* - phenyl-, 4187².
- 2-Propin-1-ol, naphthylidiphenyl-, 4187².
- C₂₁H₃₁O₂ 7-*meso*-Benzanthrenone, 4-14-hydroxy-3,5-xylyl-, P 847⁹.
- C₂₁H₃₁BrO₂ *p* - Cresol, 2 - bromo - *α* - triphenyl-, 3679⁴.
- C₂₁H₃₁O₂ *p* - Cresol, 2 - chloro - *α* - triphenyl-, 3679⁴.
- C₂₁H₃₁NO₂ Benzamide, *N,N,O* - triphenyl-, 2433⁹.
- C₂₁H₃₁NO₂ Phenol, 3,5-diphenyl-, carbanilate, 2166⁹.
- C₂₁H₃₁NO₂ 3 - Isoxant[benz - 9 - *p* - benzene-sul-fonic acid, 2,6,7-trihydroxy-3-keto-, aniline salt, 2964².
- C₂₁H₃₁N₂O₂ 2 - Naphthamide, 3 - (4,5 - dihydro-5 - keto - 3 - methyl - 1 - pyrazolyl) - *N* - 2-naphthyl-, 3909⁹.
- C₂₁H₃₁N₂O₂ Benzoic acid, *m*-[*o*-(*β*-cyano-3,4-dimethoxy - 2 - nitrostyryl)benzalamino]-, 5186⁹.
- C₂₁H₃₁Br₂N₂O₂ Malonic acid, 2-fural-, 5-*p*-bromoanilino - 1 - (*p* - bromophenyl-imino) - Δ^2 - 2 - pentadienol salt, 2438⁹.
- C₂₁H₃₁Cl₂N₂O₂ Malonic acid, 2-fural-, 5-*p*-chloroanilino - 1 - (*p* - chlorophenyl-imino) - Δ^2 - 2-pentadienol salt, 2438⁹.
- C₂₁H₃₁Hg₂O₂ Aurin, tris(acetoxymercu-), 4913⁹.
- C₂₁H₃₁N₂ Acridine, Ph₂NH compd., 3921⁹.
- C₂₁H₃₁N₂S Pseudourea, tetraphenylthio-, 1115⁹.
- Urea, tetraphenylthio-, 1115⁹; *AcAc* compd., 4471¹.
- C₂₁H₃₁N₂O₂ Carbanilide, *p,p'*-bis(phenylazo)-, 3445².
- C₂₁H₃₁N₂O₂S Carbanilide, bis-dihydroxyphenyl-azo)-thio-, 2157⁹.
- C₂₁H₃₁N₂O₂ Carbanilide, bis-dihydroxyphenyl-azo)-, 2157⁹.
- C₂₁H₃₁N₂S Carbanilide, *p,p'*-bis-phenylazo-thio-, 3445².
- C₂₁H₃₁N₂O₂ 1,1' - Trimethylenebispyridinium picrate, 931⁹.
- C₂₁H₃₁O₂ Pyrogallol, 5-triphenylmethyl-, 3679⁴.
- C₂₁H₃₁O₂ Isoflavone, 5 - hydroxy - 4' - *o* - methoxy - 2-styryl-, 2180⁹.
- C₂₁H₃₁O₂ Quinone, 2-hydroxy-3,6-bis-hydroxyphenyl-5-methoxy-acetate, 1127⁹.
- C₂₁H₃₁N Benzohydrylamine, *N,p*-diphenyl-, and -HCl, 3909¹.
- C₂₁H₃₁NO₂ Acetophenone, α -(4-ethyl-2-phenoxyquinolyloxy)-, 2443⁹.
- C₂₁H₃₁NO₂ 3,4-Phenanthrenediol, 1,2-diacetate, 1890⁹.
- C₂₁H₃₁NO₂ Phthalamic acid, *N*-(*β,β*-diethyl- α -carboxyethyl)-, anhydride, 3690⁹.
- C₂₁H₃₁NO₂ 1,3 - Propanediol, 2-hydroxy-methyl-2-nitro-, tribenzoate, P₂, 4928¹.
- C₂₁H₃₁NO₂ Benzoic acid, *m*-[*o*-(*β*-cyano-6,7-dimethoxy - 2 - indyl)benzalamino]-, *derivs.*, 5186⁹.
- C₂₁H₃₁NO₂ Barbituric acid, 5-ethyl-3-*o*-benzyl-1,3-diphenyl-, 821⁹.
- C₂₁H₃₁NO₂ Thumnic acid, *p*-nitrophenyl-hydrazone, 4477⁹.
- C₂₁H₃₁Cl₂N₂O₂ Guanidine, *β,γ*-dibenzoyl- α -chloro - *β* - hydroxypropyl-, benzoate, 2177².
- C₂₁H₃₁N₂O₂S Oxazolidine, 3-benzoyl-2-benzoyl-imino) - 5 - (benzylmercaptomethyl)-, 2177².
- Δ^2 - Oxazoline, 5 - (benzylmercaptomethyl-2-benzoylamino)-, 2177².
- C₂₁H₃₁N₂O₂ Malonic acid, 2-fural-, 5-anilino-1-phenylimino - Δ^2 - 2 - pentadienol salt, 2438⁹.
- C₂₁H₃₁N₂O₂ Thamnolic acid, phenylhydrazide, 4477⁹.
- C₂₁H₃₁N₂O₂ Acetophenone, *p* - (2-methoxy-1-naphthylazo)-, phenylhydrazide, 3461⁹.
- C₂₁H₃₁N₂O₂ Quinolone, 4,6-diethyl-2-phenylpicrate, 2443⁹.
- C₂₁H₃₁O₂ Compd., m. 180°, from *o*-methoxybenzaldehyde and PhCH₂COC(Ph)₂, 3705⁹.
- C₂₁H₃₁NO₂ Syringetin, tetracetate, 2181⁹.

- $C_{21}H_{35}Sn$ Stannane, benzyltriphenyl-, 118⁸, 5470⁹.
Stannane, triphenyl-o-tolyl-, 118⁸
- $C_{21}H_{21}NO$ Indoline, 1 - acetyl - 3,3 - dibenzyl - 2-methylene-, 3927⁷.
- $C_{21}H_{21}NO_2$ 1,2 - Pyran - 2,4(3i) - dione, 6 - benzyl-3,5-diphenyl-, compd. with MeNH-, 2430⁹.
- $C_{21}H_{21}NO_3$ Thamnolic acid, PhNH₂ salt, 1477⁸
- $C_{21}H_{21}N_2O_5$ *p* - Toluenesulfonamide, Δ - methyl - *N* - (4 - methylnitrosoamino) - 3 - phenyl 2-naphthyl-, 1467⁸.
- $C_{21}H_{21}N_2O_5$ 1,3,5 - Benzenesulfonamide, 2-hydroxy-4-methyl-, 1630⁹.
- $C_{21}H_{21}N_2O_6$ Tetryl, compd. with terec-, 3214⁸.
- $C_{21}H_{21}N_2$ Benzidine, *o,o'* methylenes-, 1633⁹.
- $C_{21}H_{21}N_2$ Urea, thio - α - (3 - *p* - tolueno - 4 - *p* - tolyl - 2(3i) thiacyclene) β - *p* - tolyl-, 1410⁹.
- $C_2H_5NO_2$ Phenethylamine, 3 - amino - Δ - (3,4 dimethoxy - 2 - nitrophenylethyl) 4-methoxy - picate, 4705⁸.
- $C_2H_5O_2$ 9 - Fluorencarboxylic acid 9 - α,β trimethylphenethyl-, 5181⁸.
- $C_2H_5O_2$ Cyclopentanone, bis(*p* - methoxyphenyl) - 1 - phenyl-, diacetate, 2178⁸, 2179⁸.
- $C_2H_5NO_2$ Cyclohexanol, 3,5 diphenyl-, carbamate, 2157⁷.
 Δ - 1 - Propenol, 1 - Δ - ethylamino 3 - 4 - diphenyl-, acetate, 2697⁸.
- $C_2H_5NO_2$ 3 Pyrazolone, 4 dibenzylamino 1,5 dimethyl 2-phenyl-, 2245⁸.
- $C_2H_5NO_2$ 3 - Isophenothiazine, 6 - dimethyl amino - 3 - methylamino, 3 - methyl acetylsalicylate, 4043⁸.
- $C_2H_5NO_3$ 1 - Thiazolidone, 5 - cyto - 5 - phenyl 2-phenylamino-, 821⁸.
- $C_2H_5NO_3$ Benzamid, *N* - benzyl - Δ - benzyl ethylcarbamoylmethyl-, 810⁸.
- $C_2H_5NO_3$ Acetamido - 2,8 - dimethoxy - 10 - methylacridinium *p* - toluenesulfonate, 1904⁸.
- $C_2H_5O_2$ Malonic acid, benzylanthrylmethyl-, di-Et ester, 2707⁷.
- $C_2H_5O_2$ Mannose, 6 trityl ether, 1942⁸.
- $C_2H_5O_2$ Glucoside, diacetylbenzoyl - β - methyl -, 2944⁸.
- $C_2H_5Cl_2O_2$, 4217⁸.
- $C_2H_5NO_3$ Protocatechuyl alcohol, α - 3,4 diacetoxybenzylaminomethyl-, 3,4 diacetate, oxalate, 5162⁸.
- $C_2H_5NO_2$ Benzoin, 4 - carboxylbenzylcarbamate, 5470⁹.
- $C_2H_5NO_2$ Propionic acid, α selenocyanate, strychnine salt, 2154⁸.
- $C_2H_5NO_3$ 4 - Isopropylpropionic acid, 2 - (1 - β - carboxyethyl) - 3,5 dimethyl 2-pyrrylmethylene 1 - 3,5 dimethyl-, picate, 11344⁸.
- $C_2H_5N_2$ Hydrazine, α - (2 - benzylphenethyl) α,β - dimethyl - β - (2,5 - xylol-, 1099⁸.
- $C_2H_5NO_2$ Barbituric acid, 5 - amyl - 5 - ethyl 1,3-bis(*p* - nitrobenzyl)-, 821⁸.
Barbituric acid, 5 - ethyl - 5 - isomethyl 1,3-bis(*p*-nitrobenzyl)-, 821⁸.
Barbituric acid, 5 - ethyl - 5 - isomethyl 1,3-bis(*p*-nitrobenzyl)-, 821⁸.
- $C_2H_5O_2$ Δ^4 - 3,5 - Heptadienedione, 1,7 di-*p*-cumenyl-, 4214⁸.
- $C_2H_5O_2P$ Methanephosphonic acid, triphenyl-, di-Pr and diisopropyl esters, 3921⁸.
- $C_2H_5NO_2$ See *Crystal violet*.
- $C_2H_5NO_2$ 3,5 - Xylenol, [*p,p'* - bis(dimethylamino)benzohydryl], 1122⁸.
- $C_2H_5NO_2$ See *Bixin*.
- $C_2H_5NO_2$ Aporphine, 3,4,6,7 - tetramethoxy-, II tartrate, 3471⁸.
- $C_2H_5NO_2$ See *Crystal violet*, *Methyl violet*.
- $C_2H_5NO_2$ 1,8(2,7) - Xanthenedione, 3,4,5,6 tetrahydro - 9 - (2 - hydroxy - 6 keto 1,1 dimethyl Δ^1 - cyclohexenyl) - 3,3,6,6 tetramethyl-, Na deriv., 3660⁸.
- $C_2H_5CINO_2$ Compd., m 166 83°, from sinomene and ClCO₂Et, 370⁸.
- $C_2H_5CINO_2P$ 4 - (HO) Phosphonic acid, β chloromethyl ester, lucine salt, 2418⁸.
- $C_2H_5O_2$ Bixin, dihydro-, 1180⁸.
- $C_2H_5O_2$ 1,8(2,7) - Xanthenedione, 3,4,5,6 tetrahydro - 9 - (2 hydroxy - 6 keto - 4,4 - dimethyl Δ^1 - cyclohexenyl) - 3,3,6,6 - tetramethyl-, 3660⁸.
- $C_2H_5O_2$ Di - Me ester, m 188 90°, of lactone triacid, 151⁸.
- $C_2H_5NO_2$ 3 - Perlepropionic acid, 2,2' - methylenes[5 - carboxy - 4 - ethyl - di - Et ester, 114⁸.
- $C_2H_5O_2$ 4 - Heptanone, 2,6 dimethyl 2,6 bis(3 - methyl α - amyl)-, 2441⁸.
- $C_2H_5O_2$ 1-naphthanthracene, tri-Me ester, 151⁸.
- $C_2H_5BrO_2$ Glucose 6 - bromohydrin, tetraacetylglucoisidomonoacetomonoacetyl-, 108⁸.
- $C_2H_5O_2$ Glucose 6 - isohydrin, tetraacetyl glucosidomonoacetomonoacetyl-, 108⁸.
- $C_2H_5NO_2$ 1-naphthanthracene, tri-Me ester, oxime, 151⁸.
- $C_2H_5NO_2$ Strychnidine, dimethosulfate, 3711⁸.
- $C_2H_5NO_2$ Cocaine, triethyl-, salt with dimethylsulfate, 2979⁸.
- $C_2H_5NO_2$ Glucoside, tetraacetyl - β - hydroxy camphor - semicarbazone, 1208⁸.
- $C_2H_5NO_2$ Aniline, 1, *p'* - (3 - methylcyclohexylidene-4,4'- Δ - Δ dimethyl) dimethiodide, 1688⁸.
- $C_2H_5NO_2$ Strychnidine, methosymethyl-tetrahydro-, dimethiodide, 3711⁸.
- $C_2H_5NO_2$ Chaulmoogric acid, benzylhydrazide, 144⁸.
- $C_2H_5NO_2$ Chaulmoogric acid, benzylhydrazide, 114⁸.
Hydrazine, α - benzyl - β chaulmoogric-, 114⁸.
- $C_2H_5NO_2$ Strychnidine, dihydro-, dimethosulfate, 3710⁸.
- $C_2H_5O_2$ Eleostearic acid, benzyl ester, 2151⁸.
- $C_2H_5O_2$ Benzene, 1-chaulmoogryl 2-hydroxy-4-methoxy-, 2949⁸.
- $C_2H_5NO_2$ Acetyl deriv., m 156°, of reduction product of digitaligenin, 152⁸.
- $C_2H_5O_2$ Di - Me ester, m 163°, of acid, m 282°, 152⁸.
Di - Me ester, m 171 2°, of acid, m 278°, 152⁸.
- $C_2H_5CdCl_2N_2O_2$, 1363⁸.
- $C_2H_5NO_2$ Chaulmoogric acid, Δ - benzyl-, 4678⁸.
- $C_2H_5NO_2$ Pyropendocaine, 2243⁸.
- $C_2H_5O_2$ Phenol, 2 - α - Δ^2 - cyclopentenyl-tridecyl 5-methoxy-, 2947⁸.
- $C_2H_5O_2$ Hydroalcohol, acetyl-, 382⁸.
Spirocamphane - 2,2' - *m* dioxane 5',5'' - *m* - dioxane 2'',2''' - camphane], 4672⁸.

- C₂₁H₄₁NO₂ Pimaric acid, piperidine salt, 4224^o.
 C₂₁H₄₁NO₂ Sprintilline, and -HCl, 474^o.
 C₂₁H₄₁N₂O₂ Isodigitoxigeninic acid, Me ester semicarbazone, 149^o.
 C₂₁H₄₁N₂O₂ Hydrazine, α -benzal- β - (8, 1-dihydroxystearyl)-, 4674^o.
 C₂₁H₄₁NO₂ Alkaloid from *Helleborus viridis*, 474^o.
 C₂₁H₄₁O₄ Bixin, perhydro-, 4480^o.
 C₂₁H₄₁O₄ Myristin, γ -caprylo- α -, 1110^o.
 C₂₁H₄₁ Pentacosane, 4438^o.
 C₂₁H₄₁BrN Docosyltrimethylammonium bromide, 4669^o.
 C₂₁H₄₁NO Docosyltrimethylammonium hydroxide, 4669^o.
 C₂₁H₄₁O₄ Anth[1, 2- α]anthrene-5, 10, 15, 16-tetrone, 3916^o.
 Dibenzo[$\beta\lambda$]chrysene-5, 8, 13, 16-tetrone, 3916^o.
 C₂₁H₄₁ Rubicene, 136^o.
 C₂₁H₄₁Br₂N₂ 13, 14-[*o, o'*-Diphenylene]dibenzot-12, 15-diazine, 3, 8-dibromo-, 3457^o.
 C₂₁H₄₁N₂O Compd., m. 240°, from *o*-C₆H₄(NH₂)₂ and 12, 13- $\alpha\beta\beta\alpha$ -dinaphthofurandione, 833^o.
 C₂₁H₄₁N₂O₂ Dibenzo[$\gamma\delta, \mu\nu$]perylene-1, 8-dione, 3, 10-diamino-, 1130^o.
 C₂₁H₄₁N₂O₂S₂ Dinaphthodithiazinequinone, 4823^o.
 C₂₁H₄₁N₂O₂S₂ Phenothioxin, 3, 3'-dithiobis[2-methyl-5, 7-dinitro- (?), 825^o.
 C₂₁H₄₁O₂ Naphthalic anhydride, 3, 4-dihydroxy-, dibenzoate, 4213^o.
 C₂₁H₄₁ Anth[1, 2- α]anthrene, 3915^o.
 Dibenzo[$\beta\lambda$]chrysene, 3915^o.
 C₂₁H₄₁As₂N₂O₂S₂ *p*-Arsenophenol, 3, 3'-di-1-benzothiazolyl-, 5184^o.
 C₂₁H₄₁As₂N₂O₂S₂ Resorcinol, 4, 4'-arsenobis[6-(1-benzothiazolyl)-], 5184^o.
 C₂₁H₄₁Cl₂N₂O₂ Anthraquinone, 2, 4, 6, 8-tetrakis(trichloroacetamidomethyl)-, 2173^o.
 Chrysozin, 2, 4, 6, 7-tetrakis(trichloroacetamidomethyl)-, 2173^o.
 C₂₁H₄₁N₂ 13, 14-[*o, o'*-Diphenylene]dibenzot-12, 15-diazine, 3457^o.
 C₂₁H₄₁N₂O₂ Acenaphthene, compd. with dinitrophenanthrenequinone, 135^o.
 C₂₁H₄₁O Spiro[fluorene-9, α' -ethylen]oxide- β' , 9', 9'-fluorene], 3919^o.
 C₂₁H₄₁O₂ Δ^3, β' -Bixanthene, 1638^o.
 C₂₁H₄₁S₂ 9-Fluorenone, 9-thio-, dimer, 3919^o.
 C₂₁H₄₁N₂ Indoloquinoxaline, diphenyl-, 3226^o.
 C₂₁H₄₁N₂O₂ Phthalimide, *N*-[4-(*p*-acetylphenylazo)-1-naphthyl]-, 3459^o.
 C₂₁H₄₁N₂O₂ Diphenylamine, *p, p'*-bis[2, 4-dinitrobenzalmino]-, 4682^o.
 C₂₁H₄₁ Ethane, dibiphenylene-, 3457^o.
 C₂₁H₄₁As₂N₂O₂S₂ *p*-Arsenophenol, 3, 3'-diamino-5, 5'-di-1-benzothiazolyl-, di-HCl, 5184^o.
 C₂₁H₄₁Br₂Cl₂O₂ Benzopinacol, 3, 4, 4'-dibromo- β, β' -dichloro-, 3922^o.
 C₂₁H₄₁Br₂N₂O₂ *o, o'*-Bianiline, 5, 5'-dibromo-*N, N'*-disulcylal-, 3457^o.
 C₂₁H₄₁Br₂N₂O Azoxybenzene, *o, o'*-bis(*p*-bromophenyliminomethyl)-, 2428^o.
 C₂₁H₄₁Br₂O₂ Benzopinacol, tetrabromo-, 3922^o.
 C₂₁H₄₁Cl₂O₂ Perylene, 2, 9-dichloro-4, 10-dipropionyl-, 1120^o.
 C₂₁H₄₁N₂O₂ Phthalimide, *N, N'*-[(hydroxymethyl)ethylen]bis- (?), benzoate, 2152^o.
 Phthalimide, *N, N'*-(2-hydroxytrimethylen)bis- (?), benzoate, 2152^o.
 C₂₁H₄₁N₂O₂S₂ Benzanilide, 2', 2''-dithiobis[5'-nitro-, 3468^o.
 C₂₁H₄₁O₂ Anthradial, 9, 10-diphenyl-, and -HCl, 3223^o.
 Benzil, *p, p'*-diphenyl-, 3923^o.
 Spiro[4, 3- β -naphthopyran-3, 9'-xanthene], 2-methyl-, 3706^o.
 C₂₁H₄₁O₂Pb₂S₂ 2-Naphthol, 3, 6, 8-trimercapto-, Et carbonate, Pb deriv., 1129^o.
 C₂₁H₄₁S₂ Sulfide, di-9-fluoryl, 3920^o.
 C₂₁H₄₁S₂ Disulfide, di-9-fluoryl, 3919^o.
 C₂₁H₄₁N₂O₂ Succinimide, *N*-1 (and 2)-naphthyl- α, β -diphenyl-, 2165^o.
 C₂₁H₄₁N₂O₂ 2-Naphthanilide, 3-(4, 5-dihydro-5-keto-3-phenyl-1-pyrazolyl)-, 3909^o.
 C₂₁H₄₁N₂O₂ 2-Naphthanilide, (4, 5-dihydro-5-keto-3-phenyl-1-pyrazolyl)-3-hydroxy-, 3909^o.
 C₂₁H₄₁N₂O₂S₂ Naphthalenesulfonic acid, anilino(sulfonaphthylazo)-, 1837^o.
 C₂₁H₄₁N₂O₂S₂ Naphthalenedisulfonic acid, aminolinosulfonaphthylazo)hydroxy-, 1837^o.
 C₂₁H₄₁N₂O₂ Picrate of benzoyl deriv. of reduction product of pyocyanin, 2717^o.
 C₂₁H₄₁ Ethylene, *as*-bis(phenylphenyl)-, 134^o.
 Ethylene, tetraphenyl-, 2171^o.
 Fluorene, 9-benzyl-9-phenyl-, 3917^o.
 C₂₁H₄₁Br₂O₂ Benzopinacol, dibromo-, 3922^o.
 C₂₁H₄₁Cl₂O₂ Benzopinacol, *o, o'*-dichloro-, 5182^o.
 C₂₁H₄₁N₂ Biacridan, 144^o, 3229^o.
 C₂₁H₄₁N₂O Anthrone, bis(aminophenyl)-, *P* 4830^o.
 C₂₁H₄₁N₂O₂ *o, o'*-Bianiline, *N, N'*-disulcylal 3457^o.
 2-Naphthol, 1-[α, β -bis(phenylmmino)ethyl]-, acetate, 2952^o.
 C₂₁H₄₁N₂O₂ Benzanilide, *o, o'*-dithiobis-, 142^o.
 C₂₁H₄₁N₂O₂ Diphenamic acid, *N*-(*p, p'*-aminophenyl)phenyl-, 127^o.
 C₂₁H₄₁N₂O₂S₂ 5-Acridansulfonic acid, acridic salt, 144^o.
 C₂₁H₄₁N₂O₂S₂ Disulfide, bis(3-nitro-2-tolylmercaptophenyl)-, 3408^o.
 C₂₁H₄₁N₂O₂ Pyocyanin, and deriv., 2717^o.
 C₂₁H₄₁N₂O₂ 2, 5-Pyrazinediol, 1, 4-dihydro-bis(1-naphthalenecarbamate)-, 5169^o.
 C₂₁H₄₁N₂S₂ 1, 2, 4-Thiadiazole, 2, 5-bis(diphenylamino)-, 1900^o.
 1, 2, 4-Thiadiazolidine, 3, 4-diphenyl-2, 5-bis(phenylimino)-, 1900^o.
 C₂₁H₄₁N₂S₂ 1, 2, 4-Benzotriazine, 3, 3'-dithio-bis[1, 4-dihydro-1-phenyl-, 1395^o.
 C₂₁H₄₁O₂ Anthradial, 9, 10-dihydro-9, 10-diphenyl-, 3223^o.
 Benzoin, *p, p'*-diphenyl-, 3923^o.
 Naphthalene, dibenzoyldimethyl-, 3915^o.
 —, 1, 8-di-*o*-tolyl-, 3915^o.
 Perylene, dipropionyl-, 2430^o, 3926^o.
 C₂₁H₄₁O₂ Naphthalene, 1, 5-dibenzoyl-1, 8-dimethoxy-, 3327^o.
 2, 9-Perylenedicarboxylic acid, di-Ester, 1361^o.
 C₂₁H₄₁O₂ Atromentin, tetraacetate, 1^o.
 C₂₁H₄₁ Trithiolane, tetraphenyl-, 379^o.
 C₂₁H₄₁Cl Methane, (4-chloro-*m*-tolyl)trithio-, 3679^o.

- $C_{12}H_{11}NO_2$ Succinamic acid, *N* - 1 (and 2) - naphthyl - α, β - diphenyl -, 2185^{2,3,4}.
- $C_{12}H_{11}NO$ Anthrone, aminobis(aminophenyl) -, P 4830⁴.
- $C_{12}H_{11}N_2$ Bibenzyl, *o, o'* - diphenyl -, 2710⁴.
- $C_{12}H_{11}N_2$ Acridine, 5 - methyl -, Ph_2NH compd, 3920⁴.
- Aniline, *N* - (α, β - diphenyl - β - phenyliminoethyl) -, 833⁴.
- Benzophenone, *o* - benzyl -, phenylhydrazone, 1409⁴.
- $C_{12}H_{11}NO_2$ 10, 10' - Diacridyl - 10, 10' - oxide, 9, 10, 9', 10' - tetrahydro -, 3224⁴.
- Pyridine, 2 - (*o* - acetamidobenzyl) - 4 β - diphenyl -, 1641³.
- $C_{12}H_{11}NO_2$ Perylenedicarhamic acid, di-Et ester, 2436⁴.
- $C_{12}H_{11}NO_2$ Anthraquinone, 3, 7 - diacetamido 1, 2, 5, 6 - tetrahydroxy -, tetraacetate, 3923⁴.
- $C_{12}H_{11}NO_2$ Benzil, 2, 4 - dihydroxy -, phenyl osazone, 833⁴.
- $C_{12}H_{11}NO_2$ Barbituric acid, 5 - ethyl - 1, 3 - bis(*p* - nitrobenzyl) - 5 - phenyl -, 821⁴.
- $C_{12}H_{11}N_2S_2$ Biurea, 1, 3, 4, 6 - tetraphenyl 2, 5 - dithio -, 3445⁴.
- (canilide, *p, p'* - bis(*p* - aminophenyl) dithio -, 3444⁴.
- $C_{12}H_{11}NO_2$ 1, 5, 9, 10 (2, 6) - Anthracenetetrone, 3, 4, 7, 8 - tetrahydroxy - 2, 6 - diisomero -, $PhNH_2$ salt, 3925⁴.
- $C_{12}H_{11}NO_2$ Bi - *o* - anisidine, dipicrate, 4456⁴.
- $C_{12}H_{11}NO$ Ether, *p* - tolyl triphenylmethyl, 1633⁴.
- $C_{12}H_{11}O$ (See also *Benzopinacol*)
- 7, 8 - Acenaphthenediol, 7, 8 - di - *o* - tolyl -, 3916⁴.
- $C_{12}H_{11}O$ Isoflavone, 4', 5, 7 - trimethoxy - 2 - styryl -, 2180⁴.
- $C_{12}H_{11}O_4$ [1, 1' - Binaphthalene] - 3, 3' - dicarboxylic acid, 2, 2' - dihydroxy -, di - Et ester, 5182⁴.
- 1, 1' - Binaphthalene] - 8, 8' - dicarboxylic acid, 5, 5' - diethoxy -, P 600⁴.
- $C_{12}H_{11}O_4$ 1, 2, 4, 5 - Benzenetetrrol, 3, 6 - bis - hydroxyphenyl) -, tetraacetate, 1127⁴.
- $C_{12}H_{11}S$ Benzohydryl sulfide, 370⁴.
- $C_{12}H_{11}ClN$ Anthracene, 0 - benzal 1, 5 - dichloro - 9, 10 - dihydro - 10 - 1 - piperidyl) -, 3222⁴.
- $C_{12}H_{11}N$ 2, 4 Xylidine, α^4 - triphenyl -, 3679⁴.
- $C_{12}H_{11}NO$ Quinaldine, 4 - (benzyloxy) - α - veratral -, 4704⁴.
- $C_{12}H_{11}NO_2$ *p* - Nitrobenzoate, m 103 - 5°, oil compd. m. 151-2°, 150⁴.
- $C_{12}H_{11}ClN_2$ Bis(*p* - (*N* - methylamino)phenyl)tellurium dichloride, 3678⁴.
- $C_{12}H_{11}NO_2$ 1, 4 - Butanediol, di - 1 - naphthalenecarbamate, 2422⁴.
- $C_{12}H_{11}NO_2$ 1 - Phenacylpyridinium sulfate, 3906⁴.
- $C_{12}H_{11}N_2S_2$ Aniline, *p, p'* - dithiobis[*N* - benzyl - (naphthylazo) -, phenylhydrazone, 3461⁴.
- $C_{12}H_{11}NO$ Begenia, bis(phenylazo) -, 3600⁴.
- $C_{12}H_{11}ClNO$ 9 - Anthrol, 9 - benzyl - 1, 5 - dichloro - 9, 10 - dihydro - 10 - (1 - piperidyl) -, 3222⁴.
- $C_{12}H_{11}NO$ 1, 2 - Pyran - 2, 4(3) - dione, 6 - benzyl - 3, 5 - diphenyl -, compd with $EtNH_2$, 2439⁴.
- $C_{12}H_{11}NO$ Rosaniline, phedolate, 404⁴.
- $C_{12}H_{11}CuO_3$ Malonic acid, phenoxyacetyl -, di-Me ester, Cu deriv., 4481⁴.
- $C_{12}H_{11}NO$ Cinnamic acid, *p* - butoxy -, *p* (*p* - anisylazo)phenyl ester, 1396⁴.
- $C_{12}H_{11}O$ Acid from $(PICH_2CH)_2$, 5181⁴.
- $C_{12}H_{11}O_2$ Cyclohexanone, bis(*p* - methoxycinnamal) -, 3911⁴.
- $C_{12}H_{11}NO_2$ Sinomenine, benzoate, and its chloroaurate, 3709⁴.
- $C_{12}H_{11}NO$ Codeinone, benzoyldihydro -, methiodide, P 5474⁴.
- $C_{12}H_{11}O$ Isocaproic acid, β - phenethyl - α, γ - diphenyl -, 5181⁴.
- $C_{12}H_{11}CrN_2O_2$, 2110⁴.
- $C_{12}H_{11}NO$ *p* - Benzotoluide, 2', 6' - dicyclohexenyl, 4685⁴.
- $C_{12}H_{11}NO$ Protocatechyl alcohol, α - (α - 3, 4 - diacetoxybenzylaminoethyl) -, 3, 4 - diacetate, ovalate, 5162⁴.
- $C_{12}H_{11}CuO_3$ Acetoacetic acid, γ - (*m* - methoxyphenoxyl) -, Et ester, Cu deriv., 4181⁴.
- $C_{12}H_{11}NO$ 1, 3 - Cyclohexanediamine, dibenzoyl - *N* - cyclohexenyl -, 1131⁴.
- $C_{12}H_{11}N_4$ Dicumphorquinoxaline, 2169⁴.
- $C_{12}H_{11}NO$ Chroman, 2, 2' - oxybis[2, 4, 4, 6 (and 2, 4, 1, 7) - tetramethyl - 2, 2' - dimtro -, 4471⁴.
- $C_{12}H_{11}NO_3$ - Triazine, 2, 4, 6 - tris(acetonilymercapto) -, bis(*p* - tolylhydrazono), 1021⁴.
- $C_{12}H_{11}ClO$ Clifoman, 2, 2' - oxybis[5 - chloro - 2, 4, 4, 7 - tetramethyl -, 4471⁴.
- $C_{12}H_{11}NO$ Camphanoquinoxaline, 7 (or 8) - amino - 8 (or 7) - (3 - camphorylidenecamano) -, 2169⁴.
- $C_{12}H_{11}N_2S_2$ Piperazine, 1, 4 - bis[5 - (benzylmercaptomethyl) - 4, 5 - dihydro - 2 - thiazyl] -, 2178⁴.
- $C_{12}H_{11}O$ Δ^1 - 3 - Heptenone, 1 - phenyl -, dimerde, 3690⁴.
- Δ^1 - 3 - Hevenone, 5 - methyl - 1 - phenyl -, dimerde, 3690⁴.
- $C_{12}H_{11}O$ Buxin, methyl-, 4480⁴.
- Isobuxin, Me ester, 4480⁴.
- $C_{12}H_{11}N$ Aniline, *p, p'* - (α - methylbenzyl)bis[*N, N* - dimethyl -, dimethiodide, 4680⁴.
- $C_{12}H_{11}O$ Chroman, 2, 2' - oxybis[2, 4, 4, 6 (and 2, 4, 1, 7) - tetramethyl -, 4471⁴.
- $C_{12}H_{11}O_2$ BMfotalone, 1413⁴.
- $C_{12}H_{11}O_2$ Tri Me ester, m 236-7°, of lactone triacid, 131⁴.
- $C_{12}H_{11}BrO$ Acetobromocellulose, 1622⁴.
- Gentiobios, 6' - bromohydrin, heptaacetate, 1063⁴.
- Maltose, bromoheptaacetate, 3444⁴.
- Melbioso, bromoheptaacetate, 3444⁴.
- $C_{12}H_{11}ClO_2$ Maltose, chloroheptaacetate, 3444⁴.
- Melbioso, chloroheptaacetate, 3444⁴.
- $C_{12}H_{11}FO_2$ Maltose, fluoroheptaacetate, 3444⁴.
- Melbioso, fluoroheptaacetate, 3444⁴.
- $C_{12}H_{11}O_2$ see *Bisgalatin*.
- $C_{12}H_{11}O_2$ Oxilil, dipropyl -, 5185⁴.
- $C_{12}H_{11}O_2$ Compd from naphthensulfonic acid P 2284⁴.
- $C_{12}H_{11}O_2$ Galactose, tetraacetylgalactododacetone -, 107⁴.
- $C_{12}H_{11}O_2$ Benzene, 1 - chaunmoogyl - 2, 4 - dimethoxy -, 2946⁴.
- $C_{12}H_{11}O$ Propionyl deriv. m 163-1°, of reduction product of thalylalgenin, 152⁴.
- $C_{12}H_{11}NO$ Hydrazine, α - (α, α - dihydroxy stearyl - β - piperonylidene -, 4674⁴.
- $C_{12}H_{11}NO_2$ 1, 1, 4, 4 - Tetraethylpiperazinium di - β - toluenesulfonate, 924⁴.

- C₂₇H₄₄O₂ Tridecane, 1 - Δ² - cyclopentenyl - 13 - (2,4 - dimethoxyphenyl) -, 2947².
- C₂₇H₄₄O₂ Parigenin, 5473¹.
- C₂₇H₄₄NO₂ Glycocholic acid, 1915²; *Na salt*, 1655².
- C₂₇H₄₄O Ketone, m. 125-6°, from acid m. 217-9°, 1647⁴.
- C₂₇H₄₄O₂ Bufocholanic acid, Et ester, 1646⁴.
- C₂₇H₄₄NO Oxime, m. 215-6°, of ketone m. 125-6°, 1647⁴.
- C₂₇H₄₄NO₂ Taurocholic acid, *Na salt*, 1655².
- C₂₇H₄₄N₂O₇ Tetraisoamylammonium picrate, 5086², 5088¹.
- C₂₇H₄₄O Euphorbol, 1212².
- C₂₇H₄₄I₂O₂ Brassic acid, diiodo-, isobutyl ester, 241⁷.
- C₂₇H₄₆Br₂O₂ *n* - Tridecoic acid, *μ* - bromo-, ester with 13 - bromo - 1 - tridecanol, 3664².
- C₂₇H₄₆I₂O₂ Behenic acid, diiodo-, isobutyl ester, P 2187⁷.
- C₂₇H₄₆O₂ Bixin, perhydro-, Me ester, 4480³.
- C₂₇H₄₆O₂ Hexacosic acid, 556².
- Phthioic acid, 4964⁷, 5502².
- C₂₇H₄₆ Hexacosane, 4438².
- C₂₇H₄₆N₂NiO₂·5 H₂O, 2385².
- C₂₇H₄₆Cl₂N₂Pt Trimethyl[β - (2,2,3 - trimethyl cyclopentyl)ethyl]ammonium chloroplatinate, 1405⁴.
- C₂₇H₄₆N₂O₂ Propine, tetraphenyl-, tetranitro deriv., 3696².
- C₂₇H₄₆O₂ 7 - *meso* - Benzanthrenone, 4 - (2 - hydroxy - 1 - naphthyl) -, P 847².
- Spiro[anthracene - 9(10), a' - ethylene oxide β', 9'' - fluorene] - 10 - one, 3919⁴.
- C₂₇H₄₇BrCl₂ Anthracene, 9 - α - bromobenzyl 1,5 - dichloro - 10 - phenyl -, 1408².
- C₂₇H₄₇N₂O₂ Phthalimide, *N* - [p - {p - (m - nitrobenzalamino)phenyl} phenyl] -, 127².
- C₂₇H₄₇Cl₂O Anthrone, 10 - benzohydril - 1,5 - dichloro -, 2172².
- C₂₇H₄₇N₂O₂ Phthalimide, *N* - [p - {p - benzal aminophenyl}phenyl] -, 127².
- C₂₇H₄₇N₂O₂ Phthalimide, *N* - [p - {p - salicyl alaminophenyl}phenyl] -, 127².
- C₂₇H₄₇O₂ 7 - γγ' - Dibenzoxantheneol. 7 phenyl -, 2967⁴.
- Spiro[1,2 - benzopyran - 2,3' - 4,3 - β - naphthopyran], 3 - phenyl -, 3705².
- C₂₇H₄₇O₂ Phloroglucinol, tribenzoyl -, 2161⁴.
- C₂₇H₄₇N₂O₂ Stilbene, compd² with 2,3,7 - trinitrofluorene, 135².
- C₂₇H₄₇N₂O₂ Nitron, trinitrobenzoate, 5130².
- C₂₇H₄₈ Propine, tetraphenyl -, 3696².
- C₂₇H₄₈N₂O₂ 1,3,4,6 - Oxadiazin - 5(4) - one, 2,4,6,6-tetraphenyl-, 1904².
- C₂₇H₄₈N₂O₂ Urea, dixanthyl-, 5209².
- C₂₇H₄₈N₂O₂ Phenolphthalein, 3 - formyl -, phenylhydrazine, 2963².
- Salgenin, 5 - phenylazo -, dibenzoate, 121².
- C₂₇H₄₈O 9 - Anthrol, 10 - benzohydril -, 3465².
- Compd., m. 135°, from PhAc and *o*-benzoyl - 8 - ketocaproic acid, 4706².
- C₂₇H₄₈O₂ *p* - Toluquinone, α - benzoyl - 5 - methoxy - α, α - diphenyl -, 4682².
- C₂₇H₄₈AlN₂ Pyridine, 2 - (2 - pyrrol) -, Al compd., 4699².
- C₂₇H₄₈Cl₂N₂O₂ 5 - Pyrazolone, 4,4' - *o* - nitrobenzylbis[1 - (o - chlorophenyl) - 3 - methyl] -, 2177².
- C₂₇H₄₈I₂ Indole, 2 - benzyl - 1,3 - diphenyl, 2177².
- C₂₇H₄₈N₂O₂ α - Toluamitide, α - benzamido - α phenylimino -, 4469².
- C₂₇H₄₈N₂O Pseudoisatin, α - benzoyl -, phenyl- osazone, 2970².
- C₂₇H₄₈O Ether, 9,10 - dihydro - 10,10 - diphenyl - 9 - anthryl hydroxyl, 3920¹.
- C₂₇H₄₈O₂ Isoflavone, 5 - hydroxy - 4',7 - dimethoxy - 2 - styryl -, acetate, 2180⁴.
- C₂₇H₄₈O₂S Hydroquinonesulfonephthalin, hydroxy -, tetraacetate, and its *Ag salt*, 2964⁴.
- C₂₇H₄₈O₁₄ Gossypetin, hexaacetate, 2181⁴.
- Quercetagenin, hexaacetate, 2181⁴.
- C₂₇H₄₈NO₂ Benzene, 1,2,3 - tris(benzoyloxy) - 5 - nitro -, 2181⁷.
- C₂₇H₄₈Propane, 1,1,1,3 - tetraphenyl -, 3696².
- C₂₇H₄₈Br₂N₂ Phenylenediamine, *N'* - benzal *N*, *N* - dibenzyl -, dibromide, 378².
- C₂₇H₄₈N₂ Phenylenediamine, *N'* - benzal *N*, *N* - dibenzyl -, *aqd* - HCl, 378².
- 2 - Propanone, 1,3 - diphenyl -, β,β - diphenylhydrazine, 4699².
- C₂₇H₄₈N₂O Benzanilide, dibenzylamino -, 378².
- C₂₇H₄₈NO₂ Carbanilide, *p*, *p'* - bis(β - phenylthiocarbamido) -, 2158².
- C₂₇H₄₈N₂O₂ Carbanilide, bis(β - phenylcarb. amido)thio-, 2157².
- C₂₇H₄₈N₂O₂ Carbanilide, bis(β - phenylcarb. amido) -, 2158².
- C₂₇H₄₈N₂O₂ Carbanilide, bis(β - phenylthiocarb. amido)thio-, 2157².
- C₂₇H₄₈O Cyclopentanone, bis(ε - phenyl - 3 - pentadienyldiene) -, 3688².
- Ether, benzyl, 2,6 - dibenzylphenyl -, 296².
- Phenetole, *p* - triphenylmethyl-, 3679².
- C₂₇H₄₈O₂ Benzene, 1,2,3 - tris(benzoyloxy) -, 2181⁷.
- C₂₇H₄₈O₂ Isoflavone, 4',5,7 - trimethoxy - 6 - methyl - 2 - styryl -, 2180⁴.
- C₂₇H₄₈O₂ *d* - Glucose, 2,3,4 - tribenzoyl -, 2944².
- C₂₇H₄₈O₁₁ Δ² - 3,5 - Heptadienedione, 1,7 - bis(2,5 - dihydroxyphenyl) tetraakis(methylcarbonate), 4211⁴.
- C₂₇H₄₈NO₂ *p* - Nitrobenzoate, m. 177.8°, of compd. m. 185-8°, 150².
- C₂₇H₄₈N₂O₂ 1,5 - Pentanediol, di 1 - naphthylencarbamate, 2423¹.
- C₂₇H₄₈N₂O₂ Malonic acid, 2 - fural - 5 - toluene 1 - tolylimino - Δ² - 4 - pentadienol salt, 2439².
- C₂₇H₄₈Stannane, benzylphenylidene - 1,2,3,4 - 118².
- Stannane, tribenzylphenyl -, 118².
- C₂₇H₄₈Cl₂N₂ 2 - *iso* - Aminobenzyl - 1 - methyl 4,6 - diphenylpyridinium iodide, methoxide, compd. with CHCl₃, 1640².
- C₂₇H₄₈Et₂g₂O₂ Pararosaniline, triacetoxymethyl-, acetate, 4943².
- C₂₇H₄₈NO₂ 1,2 - Pyran, 2,4(3) - dione, 6 - benzyl-3,5 - diphenyl-, compd. with PhNH₂, 2439².
- C₂₇H₄₈N₂O₂ Compd., decomps 285°, from dihydrohydroxycodone and (1 - 2980²).
- C₂₇H₄₈Br₂O₂ Bromothymol blue, 157².
- C₂₇H₄₈NO₂ 2 - Butanone, 1,3,4 - triphenyl - 1 (1 - piperidyl) -, 5176².
- C₂₇H₄₈N₂O₂ Spiro[furo[3,4 - γ]pyridine - 1,3,9' xanthene] - 3 - one, 3',6' - bis(methyl amino) -, 5320².
- C₂₇H₄₈N₂O₂ 1,1' - Trimethylencbispyridinium di - *p* - toluenesulfonate, 93².
- C₂₇H₄₈N₂O₂ Multiflorin, 3230².
- C₂₇H₄₈N₂O₂ Amylamine, *N*, *N* - dimethyl - β - phenethyl - *o* - phenyl -, picrate, 2963².
- C₂₇H₄₈O₂ Naringin, 5475¹.

- C₁₇H₃₅O₄P** Methanephosphoric acid, triphenyl, diisobutyl ester, 3921⁴.
- C₇H₁₃N₃O₄** Picrate, m. 179°, of compd. from sparteine cyanamide, 5188¹.
- C₁₁H₁₇O₆** 1,8(2,7) - Xanthenedione, 3,4,5,6 - tetrahydro - 9 - (2 - hydroxy - 6 - keto - 4,4 - dimethyl - Δ^1 - cyclohexenyl) - 3,3,6,6 - tetramethyl - , acetate, 3660⁹.
- C₇H₁₁AsN₂O₂** Diglycolarsenic acid, brienne salt, 595⁴.
- C₂₁H₃₁NO₁₅S** 2,3,4 - Triacetyl - α - 1 - arabinosido - 1 - pyridinium 2,3,4 - triacetyl - α - 1 - arabinosido - 1 - sulfate, 3906¹.
- 2,3,4 - Triacetyl - α - 1 - xylosido - 1 - pyridinium 2,3,4 - triacetyl - α - 1 - xylosido - 1 - sulfate, 3906¹.
- C₇H₁₁NO₄** Hydroginkgol, β - nitrobenzoyl - , 382².
- C₇H₁₁N₃O₃** Tryptophan, leucylpentaglycyl - , 374¹.
- C₇H₁₁N₃O₃** Imidazole, 2,4,5 - tricyclohexyl - 1,5 - dihydro - , styphnate, 389¹.
- C₂₇H₄₅O** Ergostatrienone, 4708¹, 4709¹.
- C₂₇H₄₅O₄** Chaulmoogric acid, *m* - carboxyphenyl ester, 3540².
- C₂₇H₄₅NO₄** Ergostatrienone, oxime, 4709¹.
- C₂₇H₄₅N₃O₃** Imidazole, 2,4,5 - tricyclohexyl - tetrahydro - , styphnate, 389¹.
- C₂₇H₄₅O** Ergostadienone, 4708¹.
- C₂₇H₄₅O** Ergostadienol, 4709¹.
- Ergosterol from spores of *Aspergillus oryzae*, 1927⁴.
- C₂₇H₄₅O** Cholesterol, α - hydroxy - , 2185¹.
- C₂₇H₄₅O₂** Compd. from ergosterol peroxide, 4708¹.
- Ergosterol peroxide, 4708¹.
- C₂₇H₄₅O₂** Monoxide, m. 218¹, of compd. from ergosterol peroxide, 4708¹.
- C₂₇H₄₅NO** Ergostadienone, oxime, 4708¹.
- C₂₇H₄₅NO₂** Oxime, m. 260°, of compd. from ergosterol peroxide, 4708¹.
- C₂₇H₄₅** Cholesterylene, 2185¹.
- Squalene, 3364¹.
- C₂₇H₄₅N₃O₃S** Strychnidine, methoxymethyl - tetrahydro - , dimethosulfate, 3711¹.
- C₂₇H₄₅O** Cholestenone, 403⁹.
- α Ergostadienol, 4709¹.
- Ergostenone, 1647¹.
- Neosterol, 4948¹.
- Zymosterol, 4948¹.
- C₂₇H₄₅O₂** Vitosterol, 3410⁹.
- C₂₇H₄₅O₂** Dihydro deriv., m. 152-3°, of compd. from ergosterol peroxide, 4708¹.
- C₂₇H₄₅AlO₂** 2,4 - Pentanedione, 3 - butyl - Al deriv., P 606².
- C₂₇H₄₅CrO₂** 2,4 - Pentanedione, 3 - butyl - Cr deriv., P 606².
- C₂₇H₄₅FeO₂** 2,4 - Pentanedione, 3 - butyl - Fe deriv., P 606².
- C₂₇H₄₅NO** Ergostenone, oxime, 1647¹.
- C₂₇H₄₅BrN₃O₃** Glutamic acid, *N* - {*N* - {*N* - [N - (N - α - bromoisocaproyl)amyl]valyl]leucyl]glycyl} - , 374¹.
- C₂₇H₄₅O** (See also *Cholesterol*.)
- Asosterol, 4948¹.
- Fecosterol, 4948¹.
- Sitosterol, 5473¹.
- C₂₇H₄₅O₂** Diol, m. 234°, from ergosterol peroxide, 4708¹.
- C₂₇H₄₅O₂** Dicarboxylic acid, m. 217-9°, from oxidation of allo - α - ergosterol, 1647¹.
- C₂₇H₄₅O₄P** Cholesterol, mono - ester with phosphoric acid, 1646¹, and salts, 2417⁹, 2418¹.
- C₂₇H₄₅N₃O₃** Glutamic acid, *N* - {*N* - {*N* - [N - (N - leucylamyl)valyl]leucyl]glycyl} - , 374¹.
- C₂₇H₄₅O** (See also *cholesterol*.)
- α Ergosterol, 4708¹.
- Sterol, m. 206-7°, from reduction of allo - α - ergosterone, 1647¹.
- C₂₇H₄₅O** Cyclohexanepropionaldehyde, trimer, 5168¹.
- C₂₇H₄₅I₂O** Brasinic acid, μ , ν - diiodo - , isoamyl ester, 241¹.
- C₂₇H₄₅IO₂** 1,2 - Propanediol, 3 - iodo-, dilactate, 1876¹.
- C₂₇H₄₅IO₂** Behenic acid, duode - , isoamyl ester, P 2187⁹.
- C₂₇H₄₅O₂** Lauric, α , ω - di - , 1876¹.
- C₂₇H₄₅O** Ginnone, 382¹.
- C₂₇H₄₅NO** Ginnone, oxime, 382¹.
- C₂₇H₄₅O** Heptacosane, 4438¹.
- C₂₇H₄₅O** Ginnol, 382¹.
- Substance from *Ginkgo biloba* leaves, 1931¹.
- C₂₇H₄₅Br₂O** Helianthrone, 11,14 - dibromo 12,13 - dihydroxy - , 2172⁸.
- C₂₇H₄₅Cl₂NO** Indanthrene, dichloro - , P 3354¹, P 3715¹.
- C₂₇H₄₅IO₂** Helianthrone, 12,13 - dihydroxy - 11,14 - duode - , 2172⁸.
- C₂₇H₄₅Cl₂O** 1,5 - Anthraquinonedicarboxylic chloride, 4,8 - diphenoxy - , 4945¹.
- C₂₇H₄₅N₃O₃** Anthraenzophenazinedione, 4947¹.
- C₂₇H₄₅N₃O₃** Indanthrene, P 2725¹, P 3715¹.
- C₂₇H₄₅N₃O₃** 1,5 - Anthraquinonedicarboxylic acid, 1,8 - bis β - nitrophenoxy - , 4945¹.
- C₂₇H₄₅N₃O₃** Bianthrone, tetramtro-, P 613¹, P 1143¹.
- C₂₇H₄₅O₂** Helianthrone, 3464¹.
- C₂₇H₄₅O₂** 1,1' - Bianthraquinone, 3464¹.
- C₂₇H₄₅O₂S** 1,5 - Anthraquinonedicarboxylic acid, 9,10 - dihydroxy - , 8,8 - bis-phenylmercapto-, dilactone, 1945¹.
- C₂₇H₄₅O₂** Binaphthylene dioxide, phthaloyl-, 3450¹.
- C₂₇H₄₅O₂** 1,5 - Anthraquinedicarboxylic acid, 9,10 dihydroxy - 4,8 - diphenoxy - , dilactone, 1945¹.
- 1,1' - P-anthraquinone, 2,2' - dihydroxy - , 2173¹.
- C₂₇H₄₅Cl₂O** Peroxide, bis(10 - chloro - 9 - phenanthryl), 123¹.
- C₂₇H₄₅IO₂** 10,10 - Bianthrone, 3,3' - dihydroxy - 2,2' - duode - , 2173¹.
- C₂₇H₄₅N₃O** Perylenediamine, phthalyl-, 2436¹.
- C₂₇H₄₅N₃O₃** 1,5 - Anthraquinedicarboxylic acid, 1,8 - diamino - 9,10 dihydroxy - , dilactone, 1945¹.
- Phthalimide, *N*, *N'* - β - biphenylenebis - , 1945¹.
- C₂₇H₄₅O₂S** 1,5 Anthraquinonedicarboxylic acid, 4,8 - bis-phenylmercapto-, 4945¹.
- C₂₇H₄₅O₂** 1,5 - Anthraquinonedicarboxylic acid, 4,8 diphenoxy - , 4945¹.
- C₂₇H₄₅N₃O** Naphthophenazinedione, phenyl-, 1895¹.
- C₂₇H₄₅N₃O** Phthalimide, *N* - {1 (naphthylazo) - 1 naphthyl} - , 3459¹.
- C₂₇H₄₅N₃O** Dibenzanthracene, picrate, 2967¹.
- C₂₇H₄₅** 9,9' - Bianthryl, 3465¹.
- C₂₇H₄₅Cl₂O₂** α , α' - Stilbenediol, β , β' - dichloro-, dibenzoate, 3923¹.
- C₂₇H₄₅N₃O** Dibenzol[*a*,*b*]pervlene - 1,8 - diene, 3,10 - bis-methylamino - (2), 1130¹.

- Dibenzo[7,8,μ]perylene - 1,8 - dione, 3,10 - diamino - 2,9 - dimethyl - (?), 1130⁷.
- C₁₂H₁₀N₂O₄ 1,5 - Anthraquinonedicarboxylic acid, 4,8 - dianilino -, 4945³.
- C₁₂H₁₀N₂O₄ [1,1' - Biphthalazine] - 4,4'(3,3') - dione, 3,3' - diphenyl-, 1128⁹.
- C₁₂H₁₀N₂O₄ [9,9' - Bianthracene] - 10 - ol, 3700², 3924⁹.
- C₁₂H₁₀O₅ [9,9' - Bianthracene] - 10 - sulfonic acid, *Na salt*, 3700², 3924⁹.
- C₁₂H₁₀O₄ [1,1' - Bianthracene] - 2,2',10,10' - tetrol, 2173¹.
- C₁₂H₁₀O₄ 1,5 - Anthracenedicarboxylic acid, 4,8 - diphenoxy -, 4945³.
- C₁₂H₁₀Cl Benzofulvene, 2 - chloro - 3,8,8 triphenyl -, 3696⁹.
- C₁₂H₁₀N [9,9' - Bianthracene] - 10 - amine, 3700², 3924⁹.
- Di - 1 - anthrylamine, 4605¹.
- C₁₂H₁₀NO₂ Compd., m. 189⁹, from chlorocodizone, 1644².
- C₁₂H₁₀ Benzofulvene, 3,8,8 - triphenyl -, 4679². Butatriene, tetraphenyl-, 3920⁹, 4679¹. Naphthalene, 1,2,4 - triphenyl-, 3920⁹.
- C₁₂H₁₀O₂ Anthraquinone, 1,5 - bis(β - tolylmercapto)-, P 1418¹.
- C₁₂H₁₀O₂ Cresol, dimercapto-, tribenzoate, 825⁹.
- C₁₂H₁₀O₂ Volemitol, tribenzoylacetate, 4192¹.
- C₁₂H₁₀O₂ Anthragallol, 2,3 - di - β - toluenesulfonate, 4697².
- C₁₂H₁₀Cl 1,3 - Butadiene, 2 - chloro - 1,1,4,4 - tetraphenyl-, 133⁹.
- C₁₂H₁₀ClO Furan, 3 - chloro - 2,5 - dihydro - 2,2,5,5 - tetraphenyl-, 134⁹.
- C₁₂H₁₀IO Furan, 2,5 - dihydro - 3 - iodo - 2,2,5 - tetraphenyl-, 1386⁹, 4678⁹.
- C₁₂H₁₀NO Phenolphthalein, 3' - (β - tolylimino-methyl)-, 2963⁴.
- C₁₂H₁₀NO₂ m - Benzotoluide, α,4' - dihydroxy -, dibenzoate, 122⁹.
- C₁₂H₁₀ Anthracene, 9 - benzohydril - 10 - methyl -, 5183¹. 1,3 - Butadiene, 1,1,4,4 - tetraphenyl -, 3921¹, 4679².
- Indan, 1 - diphenylmethylene - 3 - phenyl -, 3696⁹. Naphthalene, 1,4 - dihydro - 1,2,4 - triphenyl -, 3920⁹.
- C₁₂H₁₀N₂O₄ 4',4'' - di - β - bezanziside, 4',5'' - dibromo -, 4456⁴.
- C₁₂H₁₀Cl₂N₂O Benzidine, N, N' - bis(5 - chlorovanilla)-, 4456⁴.
- C₁₂H₁₀Cl₂O Anthrol, 10 - benzohydril - 1,5 - dichloro - 9,10 - dihydro - 9 - methyl -, 4172⁷. Furan, 3,4 - dichlorotetrahydro - 2,2,5,5 - tetraphenyl-, 134⁹.
- C₁₂H₁₀Cl₂O Perylene, 3,9 - dibutyl - 4,10 - dichloro-, 1130⁷.
- C₁₂H₁₀CuN₂O Glyoxime, diphenyl-, Cu deriv., 4692⁷.
- C₁₂H₁₀N₂ 2 - Butene, 1,1,4,4 - tetraphenyl -, 1,4 - di - K deriv., 133⁹.
- C₁₂H₁₀N₂ Δ^{4,5'} - Biacridan, 10,10' - dimethyl -, 4219⁹. Compd., m. 213⁹, from benzil and 2,3' - bi - m - toluidine, 3698⁹.
- C₁₂H₁₀N₂O Anthraquinone, 1,4 - bis(benzylamino)-, P 2189⁴. Anthraquinone, di - β - toluino -, 1275¹, P 5194¹.
- C₁₂H₁₀N₂O Chrysazol, 9,10 - dihydro - 4,5 - dimethyl - 9,10 - bis(β - nitrophenyl) -, 3223⁹.
- Rufol, 9,10 - dihydro - 4,8 - dimethyl - 9,10 - bis(β - nitrophenyl) -, 3223⁹.
- C₁₂H₁₀N₂O₂ Anthraquinone, 1,5 - bis(β - tolylsulfonamido)-, 2711².
- C₁₂H₁₀N₂N₂O₂ Sodium salt of compd. m. 271-2⁹, 2430⁴.
- C₁₂H₁₀N₂NO Glyoxime, diphenyl-, Ni deriv., 4692⁷.
- C₁₂H₁₀N₂O₂ Benzoic acid, α,α' - oxalylbis-, bisphenylhydrazine, 1128⁹.
- C₁₂H₁₀O₂ 9,9' - Bixanthyl, 9,9' - dimethyl -, 3471¹. 2 - Butene, 1,4 - diol, tetraphenyl-, 1386⁹, 4678⁹. 3,3' - Spirobi[4,3 - β - naphthopyran], 2 isopropyl-, 3705⁹.
- C₁₂H₁₀O₂ Acetic acid, phenyl (o - α - phenylphenacylphenyl) -, 3920⁹.
- C₁₂H₁₀N Indole, 1,2 - dibenzyl - 3 - phenyl -, 4699⁹.
- C₁₂H₁₀ 2 - Butene, 1,1,4,4 - tetraphenyl -, 134⁹, 3921¹. Indan, 1 - benzohydril - 3 - phenyl -, 1387. Naphthalene, 1,2,3,4 - tetrahydro - 1,2,4 triphenyl -, 3920⁹.
- C₁₂H₁₀ClN₂O₁₃ p - Toluidine, N, N' - (5 - chlorovanilla)bis[3 - nitro -, picrate, 4456⁴].
- C₁₂H₁₀ClN₂S Acetophenone, α,α' - thiobis[β - chloro-, bis(phenylhydrazine)], 1629⁹.
- C₁₂H₁₀ClN₂PtS 2 - Methyl - 1 - phenylbenzothiazolium chloroplatinate, 142⁹.
- C₁₂H₁₀N₂ Acridine, 5,10 - dihydro - 5 - methyl-compd. with 5 - methylacridine, 3921¹.
- C₁₂H₁₀N₂O Anthrone, bis(aminotolyl)-, P 4830⁴.
- C₁₂H₁₀N₂O₂ [5,5' - Biacridan] - 5,5' - diol, 10,10' - dimethyl -, 4219⁹.
- C₁₂H₁₀N₂O Benzidine, N, N' - divanilla -, *an. di-HCl*, 2983⁹.
- C₁₂H₁₀N₂O₂S Disulfide, bis[2 - (3,4 - dimethoxyphenylmercapto) - 5 - nitrophenyl], 3468⁴.
- C₁₂H₁₀N₂O Azoxybenzene, m, m' - bis(β - tolyliminomethyl)-, 2426⁹.
- C₁₂H₁₀N₂O Hydrazine, α - benzoyl - β - [β - benzoylhydrazino]diphenylacetyl-, 2977⁴.
- C₁₂H₁₀N₂O Compd., m. 271-2⁹, from α - aminophenol and oxalic acid, 2430⁴.
- C₁₂H₁₀N₂O₂ Chrysophenine, 2868⁷.
- C₁₂H₁₀N₂ Butane, 1,1,4,4 - tetraphenyl 1,4 - di - Na deriv., 134⁹.
- C₁₂H₁₀O Acetophenone, o - methyl - α,α - di-phenyl - α - o - tolyl, 5182¹. 9 - Anthrol, 10 - benzohydril - 9,10 - dihydro - 10 - methyl -, 5183¹.
- C₁₂H₁₀O₂ o - Dioxane, 3,6,6,6 - tetraphenyl -, 134⁹. Perylene, dibutyl -, 2430⁴, 3926¹.
- C₁₂H₁₀O₂S Cotoiz, di - β - toluenesulfonate, 830⁹. Isocotoiz, di - β - toluenesulfonate, 830⁹.
- C₁₂H₁₀NO₂ Malonic acid, benzohydrilphthalimido-, diethyl ester, 3690⁹.
- C₁₂H₁₀N₂O₂ Barbituric acid, δ-isopropyl 1,3,5 tris(β - nitrobenzyl) -, 521¹.
- C₁₂H₁₀N₂ p - Toluidine, N - (α,β - diphenyl - β - p - tolyliminoethyl) -, 832⁹.
- C₁₂H₁₀N₂O Strychnine, benzal-, 3711².
- C₁₂H₁₀N₂O₂ Camphanquinonazine, diamino -, dipicrate, 2169⁹, 2170⁹.
- C₁₂H₁₀O Phenetole, 2 - methyl - 4 - triphenylmethyl -, 3679⁴.

- $C_{21}H_{21}O_2$ Methane, triphenyl (3, 4, 5-trimethoxyphenyl)-, 3679⁴.
- $C_{21}H_{25}O_2$ Glucoside, 2, 3 - dibenzoyl - 4, 6 - benzylidenemethyl-, 1392⁹.
- Isosavone, 5 - hydroxy - 3', 4', 5', 6, 7 - pentamethoxy - 2 - styryl-, 2180⁹.
- $C_{21}H_{25}O_{10}$ Hydroquinone, 2, 5 - bis(*p* - hydroxyphenyl) - 3, 6 - dimethoxy-, tetraacetate, 1127⁵.
- $C_{21}H_{27}NO_2$ Norlobelanine, benzoyl deriv., 4707¹.
- $C_{21}H_{27}As_2N_2O_2$ Arsenobenzene, 4, 4' - bis(*p* - acetamidoanilino) - 3, 3' - diamino -, 2954⁴.
- $C_{21}H_{27}As_2O$ Arsine, di - *p* - tolyl-, oxide, 2955⁴.
- $C_{21}H_{27}As_2O$ Arsine, di - *p* - anisyl-, oxide, 2955⁴.
- $C_{21}H_{27}Br_2N_4$ Deuteroetioporphyrin, dibromo -, 1413⁷.
- $C_{21}H_{27}Cl_3PtS$, 20⁹.
- $C_{21}H_{27}Cl_3PtS$, 20⁹.
- $C_{21}H_{27}N_2O_2$ Strychnine, dihydrobenzal-, 3711¹.
- $C_{21}H_{27}N_2O_4$ 1, 2 - Hexanediol, di - 1 - naphthalenecarbamate, 100⁸.
- $C_{21}H_{27}N_2S$ Aniline, *p*, *p'* - dithiobis[N - benzyl-N - methyl-, 2245⁵.
- $C_{21}H_{27}Sn$ Stannane, tetratolyl-, 1368⁹.
- Stannane, *o* - tolyltri - *p* - tolyl-, 118⁹.
- , tri - *m* - tolyl - *p* - tolyl-, 118⁹.
- $C_{21}H_{27}B_3Cl_3N_2O_4$ + 10H₂O, 2117³.
- $C_{21}H_{27}NO_2$ 2 - Butanone, 4 - (3, 4 - methylenedioxypheyl) - 1, 3 - diphenyl - 4 - (1 - piperidyl)-, 5176³.
- $C_{21}H_{27}NO_3S$ Hydrastine, PhSO₂Me compd., 2159⁹.
- $C_{21}H_{27}CdN_2O_4$ Ketone, methyl pyridyl, oxime, Cd deriv., 4703².
- $C_{21}H_{27}N_4$ Deuteroetioporphyrin, 1413⁷.
- Etioporphyrin, 2984⁹.
- $C_{21}H_{27}N_4O_8$ Homoveratraniide, 3' - (β - (α - 3, 4 - dimethoxy - 2 - nitrophenylacetamido)ethyl)-2-nitro-, 5186³.
- $C_{21}H_{27}O_{10}$ Bimalonic acid, dibenzoyl-, tetra Et ester, 2946⁴.
- $C_{21}H_{27}O_8S$ Glucoside, 2, 3 - di - *p* - toluenesulfonyl - 4, 6 - benzylidenemethyl-, 1392⁹.
- $C_{21}H_{27}ClN_2O$ Strychnidine, compd. with benzyl chloride, 2711⁵.
- $C_{21}H_{27}NO_2$ 2 - Butanone, 4 - *p* - anisyl - 1, 3 - diphenyl - 4 - (1 - piperidyl)-, 5176³.
- $C_{21}H_{27}N_2O$ Naphthalene, dicyclohexyl-, picrate, 4938⁴.
- $C_{21}H_{27}BrN_2O_{14}$ Sparteine cyanamide, bromo -, picrate, 5187⁹, 5188⁴.
- $C_{21}H_{27}N_4O_8$ 2(1) - *s* - Triazole, 4 - (*p* - dimethylaminophenyl)tetrahydro - 6 - imino -, semipicrate, 4221³.
- $C_{21}H_{27}N_4O_{11}$ Chroman, 2, 2' - oxybis[2, 4, 4, 6, 8 - pentamethyl-7, 7 - dinitro -, 4471⁴.
- $C_{21}H_{27}O_{11}$ Hisperidin, 3475⁴.
- $C_{21}H_{27}O_8$ Helleborin, 473⁹.
- $C_{21}H_{27}O_{11}$ Glucoside, tetraacetylglucosidobenzal-(α -methyl)-, 108³.
- $C_{21}H_{27}N_2O_{11}$ Diglucozymintrosamine, octaacetate, 1626⁴.
- $C_{21}H_{27}O_{11}$ Chroman, 2, 3' - oxybis[2, 4, 4, 6, 8 - pentamethyl-, 4471⁴.
- $C_{21}H_{27}O_7$ Bufotakin, acetyl-, 1413³.
- $C_{21}H_{27}O_{11}$ Isosucrose, octaacetate, 2426⁴.
- Octaacetate, m. 68-70°, of disaccharide, m. 85°, 377⁹.
- Sucrose, octaacetate, 376⁴.
- $C_{21}H_{27}O_{11}S$ Di(tetraacetyl - β - *d* - mannose - 6) sulfate, 4958⁴.
- $C_{21}H_{27}NO_4$ Sarmentogenin, pyridine addn. compd., 2981⁹.
- $C_{21}H_{27}NO_{18}$ Diglucozymamine, octaacetate, 1626⁴.
- $C_{21}H_{27}O_{18}$ Cellobioside, heptaacetyl - α - ethyl-, 4195⁹.
- Maltoside, heptaacetyl - α - ethyl-, 4195⁹.
- $C_{21}H_{27}NO_{17}$ Cellobiosidodimethylamine, heptaacetyl-, 1622⁴.
- $C_{21}H_{27}N_2O_7$ 2, 6 - Lutidine, 4 - pentadecyl-, picrate, 1902⁴.
- $C_{21}H_{27}HgN_2$ Aniline, *p*, *p'* - mercuribis[N, N - dibutyl-, 1889².
- $C_{21}H_{27}O_2Th$ 2, 4 - Heptanedione, Th deriv., P 606⁹.
- $C_{21}H_{27}NO_4$ Sprintillamine, and -HCl, 474¹.
- $C_{21}H_{27}O_2$ Sterol, m. 167.4°, from beets, 4590¹.
- $C_{21}H_{27}O$ Alcohol, m. 190°, from compd. formed from ergosterol peroxide and MeMgI, 4708⁸.
- $C_{21}H_{27}NO$ Dinicotinic acid, 2, 6 - dimethyl - 4 - pentadecyl-, di - Et ester, and salts, 1902⁴.
- $C_{21}H_{27}NO$ Dinicotinic acid, 1, 4 - dihydro - 2, 6 - dimethyl - 4 - pentadecyl-, di - Et ester, 1902⁴.
- $C_{21}H_{27}O$ Euphorbol, dihydro -, acetate, 1212⁴.
- $C_{21}H_{27}O_2$ Acid, m. 84.4°, from montan wax, 5561⁴.
- Mvristic acid, tetradecyl ester, 4926⁷.
- $C_{21}H_{27}N_3O$ Ginnone, semicarbazone, 382⁹.
- $C_{21}H_{27}O$ Octacosane, 1438².
- $C_{21}H_{27}O_8Si$ Heptyl orthosilicate, 93².
- $C_{21}H_{27}N_2O$ Dinaphthacridinepentone, nitro -, P 2723⁹.
- $C_{21}H_{27}N_3O_5S$ 1, 2, 4 - Triazol - 3(2) - one, 4, 5 - dihydro - 5 - imino - 4 - phenylthio -, tri-Bz deriv., 1640¹.
- $C_{21}H_{27}O$ Acrylophenone, β , β - di - 1 - naphthyl-, 4187².
- 2 - Propin - 1 - ol, 1, 1 - β - 1 - naphthyl - 3 - phenyl-, 4187².
- $C_{21}H_{27}Cl_2O$ Anthracene, 1, 5 - dichloro - 9 - α - ethoxybenzyl-10 - phenyl-, 1408¹.
- $C_{21}H_{27}N$ Pyridine, 2, 4, 6 - triphenyl - 1 - phenyl-imino-, 1640¹.
- $C_{21}H_{27}N_2O_4$ Benzil, methyl-, dioxime, dibenzoyl-, 2709², 3, 4, 5, 7, 8.
- $C_{21}H_{27}N_2O_5S$ 1, 2, 4 - Triazole, 3 - (benzylmercaptol) - 5 - dibenzoylamino - 1 - phenyl-, 2178².
- $C_{21}H_{27}O$ Naphthol, triphenylmethyl-, 3679⁴.
- $C_{21}H_{27}O_2$ 9 - Anthrol, 10 - benzohydryl-, 3465².
- 1 - Naphthoic acid, 1, 4 - dihydro - 1, 2, 4 - triphenyl-, 3920⁹.
- $C_{21}H_{27}O_5S$ Anthraquinone, 1, 4 - bis(benzylmercaptol) - 2 - methyl-, 2712².
- $C_{21}H_{27}O_4$ 1, 2, 4 - Benzenetriol, 3, 6 - dimethyl-, tribenzoate, 4478⁴.
- $C_{21}H_{27}O_8S$ 2(1) - Benzofuranone, 1 - benzal - 5, 6 - dihydroxy -, di - *p* - toluenesulfonate, 4698⁴.
- $C_{21}H_{27}Cl_2O$ 9 - Anthrol, 10 - benzohydryl - 1, 5 - dichloro - 9 - ethyl - 9, 10 - dihydro -, 2172².
- $C_{21}H_{27}N_2O$ Anthraquinone, 2 - methyl - 1, 4 - di - *p* - toluino-, 1273¹.
- $C_{21}H_{27}N_2O_5S$ Anthraquinone, 2 - methyl - 1, 4 - bis(*p* - tolylsulfonamido)-, 2712².
- $C_{21}H_{27}N_2O$ Pseudoindole, 3, 3 - dibenzyl - 2 - methyl-, picrate, 3927⁴.
- $C_{21}H_{27}N_4O$ 2(1) - *s* - Triazole, 4 - (*p* - dimethylaminophenyl)tetrahydro - 6 - imino -, tripicrate, 4221³.

- C₂₉H₂₄O₆ Perylenetricarboxylic acid, tri - Et ester, 1130^a.
- C₂₉H₂₄BrO₄ *d* - Glucose bromohydrin, acetyl-tribenzoyl -, 2943^a.
- C₂₉H₂₄NO₂ Δ¹ - 1 - Propenol, 1 - diphenylamino - 3,3 - diphenyl -, acetate, 2697^a.
- C₂₉H₂₄O₁₁ 1,2,4 - Benzenetriol, 3,6 - bis(*p* - hydroxyphenyl) - 5 - methoxy -, penta-acetate, 1127^a.
- Chrysin, 2',3,4' - trimethoxy -, acetate 2,4 - dimethoxybenzoate, 2181^a.
- C₂₉H₂₇BrO₁₀S Glucosyl 1 - bromide, 2 - acetyl - 3 - *p* - toluenesulfonyl - 5,6 - dibenzoyl -, 1041^a.
- C₂₉H₂₇NO₄S Rotenone, oxime, benzenesulfonyl deriv., 4472^a.
- C₂₉H₂₇N₂O₁₁ Anthocyanin picrate, 24621^a.
- C₂₉H₂₇N₂O₄ Barbituric acid, 5 - butyl - 1,3,5 - tris(*p* - nitrobenzyl) -, 821^a.
- C₂₉H₂₇N₂ Aniline, acenaphthenyldienemethylene-bis(dimethyl-) -, P 715^a.
- C₂₉H₂₇N₂O₄ Isorotenone, phenylhydrazone, 601^a Rotenone, phenylhydrazone, 601^a.
- Vomicine, benzoyl-, -HCl, 3474^a.
- C₂₉H₂₈O Thymol, 6 - triphenylmethyl-, 3679^a.
- C₂₉H₂₈O₄ Malonic acid, 1 - naphthylmethyl - 2 - naphthylmethyl -, di - Et ester, 2707^a.
- C₂₉H₂₈O₄ Isoflavone, 3',4',5,5',6,7 - hexamethoxy - 2 - styryl -, 2180^a.
- C₂₉H₂₈O₁₀S Glucose, 2 - acetyl - 3 - *p* - toluene sulfonyl - 5,6 - dibenzoyl -, 104^a.
- C₂₉H₂₈BrO₁₀S Glucosyl 1 - bromide, 2 - acetyl - 3 - di - *p* - toluenesulfonyl - 6 - benzoyl -, 104^a.
- C₂₉H₂₈N₂O Benzohydrol, acenaphthenyldi-methylamino-) -, P 715^a.
- C₂₉H₂₈N₂O₄ Malonic acid, 2 - fural -, 5 - *p* - phenetidinol - 1 - *p* - phenetylmino - Δ^{2,4} - 2 - pentadienol salt, 2438^a.
- C₂₉H₂₈N₂O Carbanilide, bis(dimethylamino - phenylazo) -, 2157^a.
- C₂₉H₂₈N₂S Carbanilide, bis(dimethylamino - phenylazo)thio -, 2157^a.
- C₂₉H₂₈O Spiro[1,2 - benzopyran - 2,3' - 4,3 - β naphthopyran], 2' - octyl -, 3705^a.
- C₂₉H₂₈O₁₀S Glucose, 2 - acetyl - 3,5 - di - *p* - toluenesulfonyl - 6 - benzoyl -, 104^a.
- C₂₉H₂₈BrO₁₀S Glucosyl 1 - bromide, 2 - acetyl - 3,5,6 - tri - *p* - toluenesulfonyl -, 104^a.
- C₂₉H₂₈N₂O₁₁ Homoveratrol - 9 - aniside, 5' - [β - (3,4 - dimethoxy - 2 - nitro - α - toluyl-amino)ethyl] - 2 - nitro -, 4705^a.
- C₂₉H₂₈O₁₀S Glucose, 2 - acetyl - 3,5,6 - tri - *p* - toluenesulfonyl -, 104^a.
- C₂₉H₂₈N₂O₄ Thionine, tetraethyl -, acetyl-salicylate, 404^a.
- C₂₉H₂₈N₂O₂ - Rutanone, 4 - (*p* - dimethylaminophenyl) - 1,3 - diphenyl - 4 - (1 - piperidyl) -, 5179^a.
- C₂₉H₂₈N₂O₄ Strychnidine, methoxybenzylidihydro-, 3711^a.
- C₂₉H₂₈O₁₀ - Veratric acid, 6 - (2,2',4,4',6,6' - hexamethoxybenzohydryl) -, Me ester, 4682^a.
- C₂₉H₂₈N₂O₄ Strychnidine, methoxybenzyltetrahydro-, 3711^a.
- C₂₉H₂₈N₂O₁₁ Galactonic acid, α - keto -, brucine salt, 3440^a.
- Glucuronic acid, brucine salt, 3666^a.
- C₂₉H₂₈AsN₂O₁₀ Diglycolarsonic acid, brucine salt, 599^a.
- C₂₉H₂₈BrN₂O₁₀S 5 - Bromo - 2,3,4 - triacetyl - β - *d* - glucosido - 1 - pyridinium 6 - bromo - 2,3,4-triacetyl - β - *d* - glucosido - 1-sulfate, 3908^a.
- C₂₉H₂₈O₄ Laurin, β - mono -, disalicylate, 4685^a.
- C₂₉H₂₈N₂O₄ See *Emetine*.
- C₂₉H₂₈O₁₁ Mucic acid, tetraacetate, acid ester with salicylal, 4193^a.
- C₂₉H₂₈O₄ Githagic acid, 3475^a.
- C₂₉H₂₈N₂O Benzaldehyde, *p*-(cetoxy)-, phenylhydrazone, 1397^a.
- C₂₉H₂₈O₄ Ergostatrienol, acetate, 4709^a.
- C₂₉H₂₈O₄ Acetyl deriv., m. 168-9°, of compd from ergosterol peroxide, 4708^a.
- Githagenin, 3475^a.
- C₂₉H₂₈O₄ Compd., m. 174-5°, from oxidation of α-ergosteronol acetate, 1647^a.
- C₂₉H₂₈O₄ α-Ergostadienol, acetate, 4709^a.
- Neosterol, acetate, 4948^a.
- Zymosterol, acetate, 4948^a.
- C₂₉H₂₈INO₄ Sprintillamine, methiodide, 474^a.
- C₂₉H₂₈O₄ Cholesterol, acetate, 2185^a.
- Pecosterol, acetate, 4948^a.
- C₂₉H₂₈O₄ Acetate, m. 227°, of diol, m. 231-4708^a.
- C₂₉H₂₈O₄ α-Ergostanol, acetate, 4708^a.
- C₂₉H₂₈O₄ Dimethyl ester, m. 81-3°, of acid m. 217-9°, 1647^a.
- C₂₉H₂₈O Cyclononacosanone, 1111^a.
- C₂₉H₂₈O Nonacosanone, 4241^a.
- C₂₉H₂₈O₄ Ginnol, acetate, 382^a.
- C₂₉H₂₈O Nonacosane, 30^a, 4241^a, 4438^a, 5368^a.
- C₂₉H₂₈Cl₄O Anthraquinone, 2,2'-vinylenebis[4-chloro -, 2711^a.
- C₂₉H₂₈N₂O₂ Compd. from dinaphth[2,3-α,2,3-β]anthracene - 5,6,9,14,15,18 - hexone and N₂H₄, 1898^a.
- C₂₉H₂₈O Dinaphth[2,3-α,2,3-β]anthracene - 5,6,9,14,15,18-hexone, 1898^a.
- C₂₉H₂₈Cl₄O Anthraquinone, 2,2'-vinylenebis[4-chloro -, 2712^a.
- C₂₉H₂₈O Anthraquinone, 1,1'-oxalylo-, P 4949^a.
- C₂₉H₂₈O₄ 1 - Anthraquinonecarboxylic anhydrid, 2711^a.
- C₂₉H₂₈N₂O₄ Resorcinol, 2,4,6 triphthalimide, 2430^a.
- C₂₉H₂₈O Anthraquinone, 1 (1 anthraquinonylglycolyl) -, P 4951^a.
- Anthraquinone, 1,1' - vinylenbis[2 - hydroxy-, 2714^a.
- C₂₉H₂₈AlK₂O₄ + H₂O, 1362^a.
- C₂₉H₂₈AlNa₂O₄, 1362^a.
- C₂₉H₂₈FeK₂O₄ + 2H₂O, 1362^a.
- C₂₉H₂₈FeNa₂O₄ + H₂O, 1362^a.
- C₂₉H₂₈O Helianthrone, 11,14 dimethyl-, 2711^a.
- C₂₉H₂₈O₄ 1,1' - Bianthraquinone, 3,3 - di-methyl-, 2711^a.
- C₂₉H₂₈O₄ 1,5 - Anthracenedicarboxylic acid, 9,10 - dihydroxy - 4,8 - bis(*p* - tolylmecapto) -, dilactone, 4945^a.
- Anthraquinone, 1,1' - dithiobis[3 - methyl-, 2711^a.
- C₂₉H₂₈O₄ Dinaphth[2,3-α,2,3-β]anthracene - 5,6,9,14,15,18-hexol, 1898^a.
- C₂₉H₂₈O Anthraquinone, 1,1'-(α,β dihydroxyethylene)bis[2-hydroxy-, 2173^a.
- C₂₉H₂₈AsO₄ + 5H₂O, 1362^a.
- C₂₉H₂₈N₂O Phthalimide, *N*-(*p*-(*p* 2-hydroxy-1-naphthylazophenyl)phenyl) -, 127^a.
- C₂₉H₂₈N₂O Succinonitrile, α,β-dibenzoyl α,β-diphenyl-, 1126^a.
- C₂₉H₂₈N₂O₄ 1,5 - Anthracenedicarboxylic acid, 9,10 - dihydroxy - 4,8 - di - *p* - toluino-dilactone, 4945^a.

- $C_{20}H_{12}N_2O_4$ Anthraquinone, 1,1'-(α,β -diamino-ethylene)bis(2-hydroxy-?), 21741.
- $C_{20}H_{12}O_3$ 3 - Hexine - 1,2,6 - trione, 1,5,5,6-tetraphenyl-, 49441.
- $C_{20}H_{12}O_4$ Succinic anhydride, α,β -dibenzoyl- α,β -diphenyl-, 1126⁴.
- $C_{20}H_{12}O_5$ 1,5 - Anthraquinone-10-carboxylic acid, 4,8-bis(p -tolylmercapto)-, 4945⁴.
- $C_{20}H_{12}O_6$ 1,5 - Anthraquinone-10-carboxylic acid, 4,8-di- p -toloxy-, 4945².
- $C_{20}H_{12}N_2O_2$ 2 - Naphthamide, 3 - (3,5 - dihydro-5 - keto - 3 - phenyl - 1 - pyrazolyl) - N - 2-naphthyl-, 3909⁸.
- $C_{20}H_{12}N_2O_{11}$ Phthalic acid, N, N', N''-(α,β -di-hydroxy - 5 - phenenylidris, and *Ac sol*), 2430².
- $C_{20}H_{11}N_2O$ Benzofluorindine, acetamido-phenyl-?, 1895⁴.
- $C_{20}H_{17}MoO_4$ Molybdiyl bisdibenzoylmethane-, 1877².
- $C_{20}H_{12}N_2O_7$ Dibenzo[γ,δ,μ]perylene 1,8 dione, 3,10-bis(ethylamino)-, 1130².
- Dibenzo[γ,δ,μ]perylene 1,8 - dione, 3,10-diamino - 2,9 - diethyl-?, 1130².
- $C_{20}H_{12}N_2O_8$ Chalcone, azoxybis-, 2428².
- $C_{20}H_{12}N_2O_9$ Anthraquinone, 2,4-bis(benzamido-methyl)-1-hydroxy-, 2173⁴.
- $C_{20}H_{12}N_2O_{10}$ 1,5 - Anthraquinone-10-carboxylic acid, 4,8-di- p -toluene-, 4945⁴.
- $C_{20}H_{12}N_2O_{12}$ Dibenzofluorindine, diacetamido-?, 1895⁴.
- $C_{20}H_{12}O_4$ Anthradiol, 9,10 diphenyl-, diacetate, 3223⁴.
- 3 - Hexine - 1,6 - dione, 2,5 - dihydroxy 1,2,5,6-tetraphenyl-, 4943⁴.
- $C_{20}H_{12}O_4$ 10,10'-Bianthrone, 4,4'-dihydroxy 3,3'-dimethoxy-, 4698¹.
- Compd., m. 206⁴, from snoumenne and benzoic anhydride, 3709⁴.
- $C_{20}H_{12}O_5$ Kikokunetin, di *H*z deriv., 2717¹.
- $C_{20}H_{12}N_2O_3$ 3 - Hexine - 1,2,6 - trione, 1,5,5,6-tetraphenyl-, trioxime, 4944¹.
- $C_{20}H_{12}N_2O_7$ Pyridine, 2-(α -aminobenzyl)-4,6-diphenyl-, picrate, 1641².
- $C_{20}H_{12}Br_2O$ Ether, bis(β,β -bromo α,γ -diphenylpropenyl), 121².
- $C_{20}H_{12}ClNO_{11}$ 3,5 - Benzofurandiyl, 2-(p -chloro phenyl)-1,2 - dihydro - 1-imino - 2-(2,4,6-trihydroxyphenyl)-, pentaacetate, 4691¹.
- $C_{20}H_{12}N_4S_2$ Compd., m. 140², from 3-amino-5-(benzylmercapto) - 1-phenyl-1,2,4-triazole, 2178².
- $C_{20}H_{12}O_4$ Anthradiol, 9,10 dihydro 9,10 di-phenyl-, diacetate, 3223².
- β - Hydromuconic acid, $\alpha,\alpha,\delta,\delta$ tetraphenyl-, 134¹.
- α,α' - Stilbenediol, p,p' - dimethyl, di-benzoate, 3923¹.
- $C_{20}H_{12}S$ Thiophene, 2,5-dibenzohydryl-, 1409¹.
- $C_{20}H_{12}NO$ Indoline, 1-benzoyl-3,3-dibenzyl-2-methylene-, 3927¹.
- $C_{20}H_{12}NO_4$ 1,2-Pyran 2,4(3)-dione, 6-benzyl 3,5-diphenyl-, compd. with PhNH₂, 2439².
- $C_{20}H_{12}NO_{11}$ 3,5 - Benzofurandiyl, 1,2 - dihydro-1-imino - 2-phenyl - 2-(2,4,6-trihydroxyphenyl)-, pentaacetate, 4691¹.
- $C_{20}H_{12}$ Propine, phenyltri- p -tolyl-, 3696⁴.
- $C_{20}H_{12}Br_2O$ Ether, bis(β,γ -dibromo- α,γ -di-phenylpropyl), 121².
- $C_{20}H_{12}CHO$ 9 - Anthrol, 10 - benzohydryl - 1,5-dichloro - 9,10 - dihydro - 9 - isopropyl-, 2172².
- 9 - Anthrol, 10 - benzohydryl 1,5 - dichloro-9,10 - dihydro - 9 - propyl-, 2172².
- $C_{20}H_{12}Cl_2N_2O_4Pt$ 5 - Acetyl - 4,10 - dihydro - 10-methyl - 4 - ketophenazonium chloro-platmate, 2717².
- $C_{20}H_{12}CrO$ Pentaphenylchromium hydroxide, 1201⁴.
- $C_{20}H_{12}N_2$ Pyrazine, 3,6-dibenzyl-2,5-dihydro 2,5-diphenyl-, 1895¹.
- $C_{20}H_{12}O$ Ether, bis(α,γ -diphenylallyl), 121².
- Ether, bis(α,γ -diphenylpropenyl), 121².
- $C_{20}H_{12}O$ Benzophenone, p,p'' -1,4-butylenebis-, 4913¹.
- 9,9' - Bixanthryl, 9,9' - diethyl-, 3471⁴.
- $C_{20}H_{12}O_{11}$ Flavone, 1'-benzoyloxy 3,5,7-trihydroxy 3',5'-dimethoxy-, triacetate, 2181².
- $C_{20}H_{12}O_{12}$ 1,2,1,5 - Benzenetetrol, 3,6-bis(p -hydroxyphenyl)-, hexaacetate, 1127².
- $C_{20}H_{12}CrO$ 1,3-Butanedione, 1-phenyl-, Cr deriv., P 606⁴.
- $C_{20}H_{12}MnO_4$ 1,3-Butanedione, 1-phenyl-, Mn deriv., P 606⁴.
- $C_{20}H_{12}NO_8$ 1 - Naphthalenesulfonic acid, 4,5-dibenzyl-, PhNH₂-alt, 3923⁴.
- $C_{20}H_{12}$ Ethylene, tetra- p -tolyl-, 2950².
- $C_{20}H_{12}Cl_2O$ Butane, 2,3-dichloro 1,4-dimethoxy 1,1,4,4-tetraphenyl-, 133².
- $C_{20}H_{12}N_2$ Fluorene, 9-bis(β -dimethylamino-phenyl)methylene-, P 715⁴, 3917².
- $C_{20}H_{12}N_2S$ 1,3,4 - Thiohydazolidine, 3,4 - diethyl-2,5-bis(tolylimino)-, 1900¹.
- $C_{20}H_{12}O_{12}$ Apogossypolone, tetraacetyl-, 2941⁴.
- Glucoside, 6-acetyl 2,3,4-tribenzyloxy- β -methyl-, 2943⁴.
- $C_{20}H_{12}Br_2O_8$ 1,4 - Pyrone, 2-(3,4-methylene-dioxyethyl)-6-phenyl-, 143².
- $C_{20}H_{12}NO_4$ Malonic acid, p,p' -dimethoxybenzohydrylphthalimido-, di-Et ester, 3690⁴.
- $C_{20}H_{12}AlN_2O_4$ 1362⁴.
- $C_{20}H_{12}CoN_2O$ Compd. of α -(NO)- and pyridine, 3180¹.
- $C_{20}H_{12}CuN_2O_4$ 2905⁴.
- $C_{20}H_{12}FeN_2O_4$ 511-0, 1362².
- $C_{20}H_{12}N_2O_4$ Bruene, benzal-, -HCl, 3711¹.
- $C_{20}H_{12}N_2O_4$ Deuteroporphyrim, 1131⁴, 5192¹.
- Pyroporphyrin, 2984⁴.
- $C_{20}H_{12}NiO_4$ Compd. of Ni(NO₂)₂ and pyridine, 3180¹.
- $C_{20}H_{12}O$ Penzopinacol, ($\alpha,\alpha',\beta,\beta'$) tetra-methyl-, 3182¹.
- $C_{20}H_{12}O_8S_2$ 2 - Naphthol, 3,3' - dithiol-5,6,8-bis(methylmercapto)-, bis(ethylcarbo-ate), 1129².
- $C_{20}H_{12}O_{11}S$ Glucose, 2-acetyl-3- p -toluenesulfonyl - 5,6 - dibenzyl - β - methyl-, 104⁴.
- $C_{20}H_{12}ClFeN_4$ Phylloetioporphyrim, Fe complex, 1113⁴.
- $C_{20}H_{12}HgN_2$ Aniline, p,p' - mercuobis[N-benzyl-N-ethyl-, 1889¹.
- $C_{20}H_{12}N_2O_8S$ [1,1' - 3,2' - naphthylamine], camphorsulfonate, 3698⁴.
- $C_{20}H_{12}N_2S$ Aniline, p,p' - diethylobis[N-benzyl-N-ethyl-, 2245¹.
- $C_{20}H_{12}O_4$ d - Glucose, 6-ethyl 3-acetyl-1,2-isopropylidene-, 1675¹.
- $C_{20}H_{12}O_{11}S$ Glucoside, 2-acetyl-3,5-di- p -toluene sulfonyl 6-benzyl- β -methyl-, 104⁴.
- $C_{20}H_{12}BrN_4$ Phylloetioporphyrim, bromo-, 1413⁴.
- $C_{20}H_{12}NO_4$ 1,2 - Pyran - 2,4(3) - dione, 6-benzyl 3,5-diphenyl-, compd. with NEt₃, 2439².

- C₃₀H₂₄N₄ Phylloetioporphyrin, 1413³.
 Pyrroetioporphyrin, 5192¹.
 C₃₀H₂₄O₁₁S₂ Glucose, tri-*p*-toluenesulfonylmonoacetone-, 104⁴.
 C₃₀H₂₄O₁₁S₂ Glucoside, 2-acetyl-3,5,6-tri-*p*-toluenesulfonyl- β -methyl-, 104⁴.
 C₃₀H₂₄ Propene, 3-cyclohexyl-1-tri-*p*-tolyl-, 3696⁹.
 C₃₀H₂₄N₂O₂ Undephanthontiacid, tri-Me ester, phenyl- γ -lactazam, 151³.
 C₃₀H₂₄N₂O₂ Benzyl alcohol, α -[α -(furylmethylamino)ethyl]-, oxalate, 4205².
 C₃₀H₂₄N₂O₂ Bismuthine, trithymyl-, 118⁹.
 C₃₀H₂₄N₂O₂S Quitaine, camphorsulfonate, 1801⁴.
 C₃₀H₂₄O₂ Δ^1 -3-Nonenone, 1-phenyl-, dimeride, 3696⁹.
 Δ^1 -3-Octenone, 7-methyl-1-phenyl-, dimeride, 3696⁹.
 C₃₀H₂₄N₂O₂ Diglucosylamine, nonacetate, 1626¹.
 C₃₀H₂₄N₂O₂ Galactose, 6- β -cellobiosido-, phenylosazone, 107⁴.
 Galactose, 6- β -lactosido-, phenylosazone, 107⁴.
 C₃₀H₂₄AsN₂O₁₁ Triglycolarsenic acid, brucine salt, MeOH compd., 593⁹.
 C₃₀H₂₄O₂ (See also *Periplocyamarin*.)
 Sarmetocymarin, 2981⁴.
 C₃₀H₂₄ Lactucene, 5192¹.
 C₃₀H₂₄ Lactucane, 5192¹.
 Squalene, 2053⁴, 4559⁴.
 C₃₀H₂₄O Amyrin, 1647¹.
 Lactucerosol, 5192¹.
 C₃₀H₂₄O₂ Allobetulin, 2961².
 C₃₀H₂₄N₂O₂ Pimaric acid, β , β' -dimethylidibutylamine salt, 4224⁴.
 C₃₀H₂₄N₂O₂ Docosylamine, *N*, *N*-dimethyl-, picrate, 4669⁹.
 C₃₀H₂₄O₄ 1,28-Octacosanedicarboxylic acid, 1111¹.
 C₃₀H₂₄N₂O Cyclononacosanone, semicarbazone, 1111¹.
 C₃₀H₂₄Ag₃Cr₃N₂O₁₁ + 4H₂O, 1587¹.
 C₃₀H₂₄Ag₃N₂O₁₁ + 13H₂O, 1587¹.
 C₃₀H₂₄O₂ Acid from mugtan wax, 5561⁴.
 Myristic acid, cetyl ester, 4926⁷.
 C₃₀H₂₄ Tricantane, 1866⁹, 4438², 4667¹.
 C₃₀H₂₄O₂ 7-*meso*-Benzanthreneone, (anthraquinonylmercapto)-, P 4711¹.
 C₃₀H₂₄O₂ 7-*meso*-Benzanthreneone, 1,2- β -dihydroxy-, dibenzoate, 2433⁴.
 C₃₀H₂₄N₂O₂ Naphthalimide, *N*-[β -[β -(*m*-nitrobenzalamino)phenyl]phenyl]-, 127⁴.
 C₃₀H₂₄N₂O₂ Naphthalimide, *N*-[β -(β -benzalamino)phenyl]phenyl]-, 127⁴.
 C₃₀H₂₄N₂O₂ Naphthalimide, *N*-[β -(β -salicylaminophenyl)phenyl]-, 127⁴.
 C₃₀H₂₄N₂O₂ Phenolphthalein, 3'-(2-naphthyliminomethyl)-, 2963⁴.
 C₃₀H₂₄Br Methane, [*m*(and *p*)-bromophenyl]-bis(*p*-phenylphenyl)-, 3922⁴.
 C₃₀H₂₄BrO Carbinol, [*m*(and *p*)-bromophenyl]-bis(*p*-phenylphenyl)-, 3922⁴.
 C₃₀H₂₄N₂O Pyridine, 2-(α -benzamidobenzyl)-4,6-diglycyl-, 1641¹.
 C₃₀H₂₄O *p*-Cresol, α , α' -diphenyl- α -(phenylphenyl)-, 3679⁴.
 C₃₀H₂₄O₂ Δ^1 -3,5-Heptadienedione, 1,7-bis(4-hydroxy-1-naphthyl)-, bis(methylcarbonate), 4211².
 C₃₀H₂₄N₂O₂ Phenol, dibenzyl-, 1-naphthalene-carbamate, 2955².
 C₃₀H₂₄OP Phosphine oxide, diphenyl(triphenylmethyl)-, 3921⁴.
 C₃₀H₂₄O₂ 9-Anthrol, 10-benzohydryl-9-butyl-1,5-dichloro-9,10-dihydro-9-isobutyl-, 2172⁷.
 9-Anthrol, 10-benzohydryl-1,5-dichloro-9,10-dihydro-9-isobutyl-, 2172⁷.
 C₃₀H₂₄O₁₁ Glucose, diacetyltribenzoyl-, 2943⁴, 2944².
 C₃₀H₂₄Fe₂N₂O₂ 363⁴.
 C₃₀H₂₄N₂O₂ Methyl ester, m. 246-7°, of compd. m. 271-2°, 2430⁴.
 C₃₀H₂₄ClFe₂N₂O₂ Phylloporphyrin, complex Fe salt, 1414⁴.
 C₃₀H₂₄CuN₂O₂ Phylloporphyrin, Cu salt, 1414⁴.
 Pyrroporphyrin, Cu salt, 1414⁴, 5190⁴, 5191³.
 C₃₀H₂₄MgN₂O₂ Pyrroporphyrin, Mg salt, 1414⁴.
 C₃₀H₂₄N₂O Phylloporphyrin, 1413³.
 Phylloverdin, 1413³.
 Pyrroverdin, 1413³.
 C₃₀H₂₄N₂ Carbanilide, β , β' -isopropylidenebis[α -methylthio-, 4688⁷.
 C₃₀H₂₄N₂O₂ Pararosaniline, hexamethyl-, picrate, 404².
 C₃₀H₂₄BrN₂O₂ Phylloporphyrin, bromo-, 1414⁴.
 Pyrroporphyrin, bromo-, 1414⁴.
 C₃₀H₂₄MgN₂O₂ Malonic acid, 2-fural-, 1-3-pseudocumylimino-5-(2,4,5-trimethylaminolimo)- Δ^1 , 4-2-pentadienol salt, 2438⁹.
 C₃₀H₂₄N₂O₂ Phylloporphyrin, and salts, 1414⁴.
 di-HCl, 5190³.
 Pyrroporphyrin, 5191³; and salts, 1414⁴.
 C₃₀H₂₄N₂O₂ Phyllochlorin, 5190³.
 C₃₀H₂₄N₂O₂ Undephanthontiacid, tri-Me ester, phenylhydrazone, 151³.
 C₃₀H₂₄N₂O₂ Barbituric acid, allylisobutyl-, quinine compd., P 607².
 C₃₀H₂₄N₂O₂ Stephanoline, and -HCl, 2970³.
 C₃₀H₂₄O₂ Myristin, β -mono-, disalicylate, 468⁹.
 C₃₀H₂₄N₂O₂ Ornithine, *N*, *N'*-bis(*N*-phenylcarbamylleucyl)-, 1114².
 C₃₀H₂₄AsN₂O₁₁ Triglycolarsenic acid, brucine salt, EtOH compd., 593⁹.
 C₃₀H₂₄N₂O₂ Pyropseudoaconine, triacetyl-, 2243².
 C₃₀H₂₄N₂O₁₁ Cellobiosidopiperidine, heptacetyl-, 1622⁹.
 C₃₀H₂₄O₂ Rhodotoxin, 1691¹.
 C₃₀H₂₄O₂ Myristin, α , γ -di-, 1876⁴.
 C₃₀H₂₄ Hentriacontane, 2740², 4438².
 C₃₀H₂₄O₂ 7,14-Naphthodianthrene-dione, 3,1-dihydroxy-2-iodo-, diacetate, 2172².
 C₃₀H₂₄Br₂O₂ Helianthrone, 11,14-dibromo-12,13-dihydroxy-, diacetate, 2172².
 C₃₀H₂₄I₂O₂ Helianthrone, 12,13-dihydroxy-11,14-diiodo-, diacetate, 2172².
 C₃₀H₂₄O₂ 2-Anthraquinonecarboxylic acid, 4,4'-vinylenebis[3-hydroxy-, 2174³.
 C₃₀H₂₄O₂ 2-Anthraquinonecarboxylic acid, 4,4'-(α , β -epoxyethylene)bis[3-hydroxy-, 2174³.
 C₃₀H₂₄I₂O₂ Δ^1 , Δ^2 -Bianthrone, 3,3'-dihydroxy-2,2'-diiodo-, diacetate, 2173⁴.
 C₃₀H₂₄N₂O₂ Anthraquinone, 1-hydroxy-2,4-bis(phthalimidomethyl)-, 2173⁴.
 C₃₀H₂₄N₂O₂ Hystazarin, 1,4-bis(phthalimidomethyl)-, 2173⁴.
 C₃₀H₂₄O₂ 9,9'-Bi-1-anthraic acid, 9,9',10,10'-tetrahydro-9,9'-dihydroxy-10,10'-diketo-2,2'-dimethyl-, di- γ -lactone, 4666¹.
 C₃₀H₂₄O₂ 1-Anthraquinonecarboxylic anhydride, 2,3'-dimethyl-, 2711⁴.
 C₃₀H₂₄O₂ 2,2'-Bianthrquinone, 3,3'-dihydroxy-, diacetate, 2173⁴.

- $C_{22}H_{12}O_2$, 10,10' - Bianthrone, 3,3' dihydroxy-2,2' - diodo-, diacetate, 2173¹.
- $C_{22}H_{12}O_2$, Anthraquinone, 1,1'-vinylenebis[4-hydroxy-3-methyl-, 2174².
- $C_{22}H_{12}CuN_2O_2$, 2-Naphthol, 1-(nitrophenylazo)-, Cu deriv., 3460¹, 3461¹.
- $C_{22}H_{12}N_2O_2$, Phthalamic acid, N,N' -(9,10-dihydro - 4 - hydroxy - 9,10 - diketo - 1,3-anthrylenedimethylene)bis-, 2173¹.
- $C_{22}H_{12}N_2O_2$, 1,1'-Binaphthyl, 2,2'-bis(2,4-dihydroxyphenylazo)-, 3698¹.
- $C_{22}H_{12}NiN_2O_2$, 2-Naphthol, 1-(nitrophenylazo)-, Ni deriv., 3460¹, 3461¹.
- $C_{22}H_{12}CoN_2O_2$, 2 - Naphthylamine, 1 - (nitrophenylazo)-, Co deriv., 3461¹.
- $C_{22}H_{12}CuN_2O_2$, 2-Naphthol, 1-(β -hydroxyphenylazo)-, Cu deriv., 3460¹.
- $C_{22}H_{12}CuN_2O_2$, 2-Naphthylamine, 1 (nitrophenylazo)-, Cu deriv., 3461¹.
- $C_{22}H_{12}N_2O_2$, Anthraquinone, 1,1'-(α,β -diaminoethylene)bis[4 - hydroxy - 3 - methyl (?), 2174².
- $C_{22}H_{12}NiN_2O_2$, 2-Naphthol, 1-(β -hydroxyphenylazo)-, Ni deriv., 3460¹.
- $C_{22}H_{12}N_2O_2$, See *Congo red*.
- $C_{22}H_{12}N_2O_2$, Barbituric acid, 1,3,5,5-tetrakis-(β -nitrobenzyl)-, 821¹.
- $C_{22}H_{12}NiN_2O_2$, 2 - Naphthylamine, 1 - (nitrophenylazo)-, Ni deriv., 3461¹.
- $C_{22}H_{12}N_2O_2$, Hystazarin, 1,1' - (α - amino - β - hydroxyethylene)bis[4 - (aminomethyl) -], di-HCl, 2174².
- $C_{22}H_{12}N_2O_2$, 1,5 - Anthraquinonedicarboxylic acid, 4,8-dianilino-, di Et ester, 4945¹.
- $C_{22}H_{12}N_2$, Aniline, fluorylidenemethylenebis[di-methyl-, P 715¹.
- $C_{22}H_{12}N_2O_2$, Benzidine, N,N' - bis-4 - hydroxy-3 - methoxycinnamyl)-, and di HCl, 2983¹.
- $C_{22}H_{12}Cl_2O_2$, 9 - Anthrol, 10 - benzohydryl - 1,5-dichloro - 9,10 - dihydro - 9 - isoamyl-, 2172¹.
- $C_{22}H_{12}O_2$, 9,9' - Bixanthy, 9,9' - dipropyl-, 3471¹.
- $C_{22}H_{12}O_2$, Phenol, p,p' - 2,5 - hexylenebis-, dibenzoate, 4688¹.
- Phenol, p,p' - (1,1,3-trimethyltrimethylene) - bis-(?), dibenzoate, 4688¹.
- $C_{22}H_{12}O_2$, Benzoic anhydride, 4,4'-bis(benzyl-oxy) - 3,3',5,5' - tetramethoxy-, 2151¹.
- $C_{22}H_{12}Br_2N_2O_2$, Deuteroporphyrin, dibromo-, di-Me ester, 1134¹.
- $C_{22}H_{12}ClFeN_2O_2$, Deuteroporphyrin, di-Me ester, Fe deriv., 1134¹.
- Rhodohemin, 1412¹.
- $C_{22}H_{12}ClN_2O_2$, Rosaniline, -HCl, phenol compd., 4041¹.
- $C_{22}H_{12}CuN_2O_2$, Deuteroporphyrin, di Me ester, Cu complex, 5180¹.
- Verdoporphyrin, Cu complex, 5180¹.
- $C_{22}H_{12}N_2S_2$, Carbanilide, p,p' - cyclohexylidenebis[thio-, 4687¹.
- 1,1 - Piperazinedicarboxanilide, N,N' - dibenzylidithio-, 2178¹.
- $C_{22}H_{12}N_2O_2$, Benzil, bis[4 - (α - methylbenzyl)-semicarbazone], 1231¹.
- 5,6 - Benzoquinoxaline, 2,3 - dimethyl-, salt with dimethylglyoxime, 2978¹.
- $C_{22}H_{12}ClFeN_2O_2$, Etioporphyrin, trinitro-, complex Fe salt, 1414¹.
- $C_{22}H_{12}CuN_2O_2$, Etioporphyrin, trinitro-, Cu salt, 1414¹.
- $C_{22}H_{12}CuN_2S_2$, 4420¹.
- $C_{22}H_{12}Br_2O_2$, Fluorecein, dibromodibenzyl-, 3458¹.
- $C_{22}H_{12}CuN_2O_2$, Phylloporphyrin, Me ester, Cu complex, 5190¹.
- Pyroporphyrin, Me ester, Cu complex, 5190¹.
- $C_{22}H_{12}HgO_2$, Fluorecein, dihexyl-, Hg deriv., 3158¹.
- $C_{22}H_{12}N_2O_2$, Deuteroporphyrin, di-Me ester, 1134¹, 5180¹.
- Rhodoporphyrin, 5190¹, 5191¹, and di-HCl, 5189¹, 5190¹.
- Verdoporphyrin, 5189¹.
- $C_{22}H_{12}N_2S_2$, Carbanilide, p,p' - 2,5-hexylenebis[thio-(?), 4688¹.
- Carbanilide, p,p' - α - methylpropylidenebis[thio-methylthio-, 4689¹.
- , p,p' - (1,1,3-trimethyltrimethylene) - bis[thio-(?), 4688¹.
- $C_{22}H_{12}O_2$, Glucose, 6 (nonyl 3,5-diacetyl-1,2-isopropylidene-, 4675¹.
- Pseudogossypolone, tetramethoxy-, 2944¹.
- $C_{22}H_{12}BrN_2O_2$, Phylloporphyrin, bromo-, Me ester, 1414¹.
- Pyroporphyrin, bromo-, Me ester, 1414¹.
- $C_{22}H_{12}N_2O_2$, Etioporphyrin, trinitro-, and salts, 1411¹.
- $C_{22}H_{12}CuN_2O_2$, Benzyl alcohol, α -(β -hydroxy-benzylamino)ethyl-, Cu deriv., 4205¹.
- $C_{22}H_{12}KN_2O_2$, Etioxanthoporphinogen, di K salt, 1413¹.
- $C_{22}H_{12}NNa_2O_2$, Etioxanthoporphinogen, di-Na salt, 1413¹.
- $C_{22}H_{12}N_2O_2$, Pyrrotoporphyrin, acetyl-, 5191¹.
- $C_{22}H_{12}N_2O_2$, Phylloporphyrin, Me ester, 1414¹.
- Pyroporphyrin, Me ester, 1414¹, 5191¹.
- $C_{22}H_{12}O_2$, Fluorescein, dihexyl-, 3158¹.
- $C_{22}H_{12}O_2$, 1,8,2,7 - Xanthochrom, 3,4,5,6-tetrahydro - 9 - (2 - hydroxy - 6 - keto-4,4-dimethyl- Δ^1 -cyclohexenyl) 3,3,6,6-tetramethyl-, benzoate, 3660¹.
- $C_{22}H_{12}KN_2O_2$, Etioxanthoporphinogen, K salt, 1413¹.
- $C_{22}H_{12}N_2$, Etiomesoporphyrin, 2984¹.
- Etioporphyrin, m 341¹, 1413¹.
- Me-etio-porphyrin, 1413¹.
- $C_{22}H_{12}N_2O_2$, Phyllochlorin, Me ester, 5190¹.
- $C_{22}H_{12}N_2O_2$, Etioxanthoporphinogen, and salts, 1414¹.
- Xanthoporphinogen, 1414¹.
- $C_{22}H_{12}O_2$, Hesperidin, diacetyl deriv., 3475¹.
- $C_{22}H_{12}CuO_2$, Δ^1 - 2,4 - Hexenedione, 6 - α - cumenyl-, Cu deriv., EtOH addn. compd., 4231¹.
- $C_{22}H_{12}O_2$, Celluloside, heptaacetyl- β -phenyl-, 4196¹.
- $C_{22}H_{12}N_2O_2$, Chroman, 2,2'-oxybis(isopropyl)tetramethylnitro-, 4471¹.
- Homostephanolone, and -HCl, 2979¹.
- $C_{22}H_{12}O_2$, Δ^1 - 3 - Decenone, 1 - phenyl-, dimeride, 3696¹.
- Δ^1 - 3 - Hexenone, 1 - β -cumenyl-5-methyl-, dimeride, 3696¹.
- $C_{22}H_{12}O_2$, Δ^1 - 3 - Nonenone, 1 - β -amyl-, dimeride, 3696¹.
- $C_{22}H_{12}O_2$, Chroman, 2,2'-oxybis(isopropyl)tetramethyl-, 1471¹.
- $C_{22}H_{12}O_{18}$, Celluloside, heptaacetyl α cyclohexyl-, 4196¹.
- $C_{22}H_{12}NO_2$, See *1 era*, *ne*.
- $C_{22}H_{12}NO_2$, Pseudocoumne, triacetyl(methyl-, 2243¹.
- $C_{22}H_{12}O_2$, Parigenin, glucoside, 5173¹.
- $C_{22}H_{12}O_2$, 5561¹.
- $C_{22}H_{12}$, See *Dutridantone*.

- C₂H₅ClO₂P Phosphoryl chloride, diacetyl-, 2417⁹.
- C₂H₅O₂P Cetyl alcohol, di-ester with phosphoric acid, *Bu salt*, 2417⁹.
- C₂H₅O₂Si Octyl orthosilicate, 93².
- C₂H₇K₂O₂ Phenolphthaleineindihydroquinone, tri-K deriv., 2963⁹.
- Phenolphthaleineindiresorcinol, tri-K deriv., 2963⁹.
- C₂H₅O₂ Phenolphthaleineindihydroquinone, 2963⁹.
- Phenolphthaleineindiresorcinol, 2963⁹.
- C₂H₅O₂ Phenolphthaleineindipyrrogallol, 2963⁹.
- C₂H₅N₂O₂S₂ Fluorene, 2,7-bis(1-hydroxy-4-sulfo-2-naphthylazo)-, 2171⁷.
- C₂H₅N₂O₂ Phenolphthalein, 3'-(*p*-phenylazo-phenyliminomethyl)-, 2963⁹.
- C₂H₅Cl₂O Anthrol, 10 - benzohydryl - 1,5 dichloro - 9,10 - dihydro - 9 - phenyl, 2172⁷.
- C₂H₅N₂O₂S Carbanilide, bis(2-hydroxynaphthylazo)thio-, 2157⁹.
- C₂H₅N₂O₂ Carbanilide, bis(2 hydroxy 1-naphthylazo)-, 2157⁹.
- C₂H₅N₂O₂S₂ Fluorene, 2,7-bis(1-amino 4-sulfo-2-naphthylazo)-, 2171⁷.
- C₂H₅N₂S Urea, *s*-bis(phenylazonaphthyl)thio-, 3445³.
- C₂H₅O Carbinol, di 9 fluorylphenyl-, 3917⁴.
- C₂H₅O Anthrol, 10 - benzohydryl 9,10 dihydro-9-phenyl-, 5183¹.
- C₂H₅O Mesitol, $\alpha^2, \alpha^3, \alpha^4, \alpha^6$ - tetraphenyl, 1632².
- C₂H₅O₄ Gossypolone, tetraacetyl-, 2944⁸.
- C₂H₅N₂O₂ 2-Butanone, 1,3,4-triphenyl 4-1 piperidyl-, picrate, 5176².
- C₂H₅O₂ 3,3'-Spirobi[4,3 β -naphthopyran], 2 octyl-, 3705⁹.
- C₂H₅ClFeN₂O₂ Phyllochlorohemin, acetate, 5190⁴.
- Pyrochlorohemin, acetate, 5190⁴.
- C₂H₅CuN₂O Rhodin, complex Cu salt, 1414¹.
- C₂H₅MgN₂O Rhodin, complex Mg salt, 1414¹.
- C₂H₅N₂S₂ Carbanilide, *p,p'*-3-methylcyclohexylidene)bis(thio-, 4688⁹.
- C₂H₅O₄ Mannose, tetraacetyl-, trityl ether, 4933¹.
- C₂H₅O₄ Quercitrin, heptaacetate, 1645⁴.
- C₂H₅N₂O₂ Pararosaniline, hexamethyl-, II phthalate, 404¹.
- C₂H₅As₂O₂ See *Ergolamine*.
- C₂H₅N₂O Rhodin, 1414¹.
- C₂H₅N₂O₂ Compd. from hemin, 5191⁴.
- Phyllomorphyrin, acetate, 5190⁴.
- Pyrrhoporphyrin, acetate, 5190⁴.
- C₂H₅N₂O₂ Rhodoporphyrin, mono-Me ester, 5190⁴.
- C₂H₅N₂O₂ Porphyrin from pheophorbide a, 4225⁹.
- C₂H₅N₂O Compd., m. 285°, from chlorinmonocarboxylic acid, 5190⁴.
- C₂H₅ClFeN₂O₂ Chlorinmonocarboxylic acid, Fe complex salt, 5191⁴.
- C₂H₅CuN₂O₂ Chlorinmonocarboxylic acid, Cu complex salt, 5191⁴.
- C₂H₅N₂O Porphyrin alcohol, m. 290°, from pyrrhoporphyrin, 1414¹.
- C₂H₅N₂O₂ Chlorinmonocarboxylic acid, 5190⁴.
- C₂H₅N₂O₂S Tetraacetyl - β - *d* - galactosido - 1-pyridinium tetraacetyl - β - *d* - galactosido-1-sulfate, 3906².
- C₂H₅N₂O₂ Palmitin, bis(*p*-nitrobenzoate), 2152⁹.
- C₂H₅N₂ Ergostenone, phenylhydrazone, 1647⁹.
- C₂H₅NO₁₁ Pseudoaconine, triacetylmethyl-, 2243⁹.
- C₂H₅O₂ Sitosterol, glucoside, 5473¹.
- C₂H₅ Tritracontane, 4438².
- C₂H₅Cl₂O₂ Isoviolanthrone, dichloro-, 14830⁴.
- Violanthrone, 3,12-dichloro-, 4945⁹.
- C₂H₅ClO₂ Isoviolanthrone, 2-chloro-, 4946⁹.
- C₂H₅Cl₂O₂ [4,4' - Bi - 7 - *meso* - benzanthrene] 7,7'-dione, 9,9'-dichloro-, 4945⁹.
- C₂H₅O₂ Isoviolanthrone, 4695³, 4946¹, p. 5047⁷.
- Violanthrone, 4945⁹.
- C₂H₅ClO₂ [Bi - 7 - *meso* - benzanthrene] - 7,7'-dione, chloro-, 4946¹, 3.
- C₂H₅FO₂ [3,4' - Bi - 7 - *meso* - benzanthrene] 7,7'-dione, 3' fluoro-, 4946¹.
- C₂H₅Br₂N₂ Compd. from reduction product of 3,4,9,10 - tetranitroperylene and BrC₆H₄COCl, 2436⁷.
- C₂H₅Br₂O₂ Perylene, bis(bromobenzoyl), 2436⁷, 4695³.
- C₂H₅Cl₂N₂ Compd. from reduction product 3,4,9,10 - tetranitroperylene and ClC₆H₄COCl, 2436⁷.
- C₂H₅Cl₂N₂O₂ 5,6,12,13(7,14) - α - Quinacridinetetrone, bis- α - chlorobenzamido, 2444⁹.
- C₂H₅Cl₂O₂ Perylene, 3,9-bis(chlorobenzoyl), 1351¹, 4695³.
- C₂H₅Cl₂O₂ Perylene, 3,9-bis(chlorobenzoyl), 4695³.
- C₂H₅O₂ [Bi 7-*meso* benzanthrene] 7,7'-dione, P 1651⁹, 4945³, 4916⁷.
- C₂H₅O₂S 7 - *meso* - Benzanthreneone, α thiohis-, P 3236⁹.
- C₂H₅O₂S 7 - *meso* - Benzanthreneone, α thiohis-, P 3236⁹.
- C₂H₅O₂ Binaphthylene dioxide, dibenzo-, 3459¹.
- C₂H₅N₂O₁₀ Resorcinol, 2,4,6 triphthalimide, diacetate, 2430¹.
- C₂H₅Br₂N₂O₂ Perylene, 3,9 bis(*p* bromobenzamido)-, 4212¹.
- Perylenediamine, bis(*p* - bromobenzoyl), 2436⁷.
- C₂H₅Cl₂N₂O₂ Perylene, 3,9 dibenzamido 4,10 dichloro-, 4212¹.
- Perylenediamine, bis(*p* - chlorobenzoyl), 2436⁷.
- C₂H₅N₂ Compd. from reduction product of 3,4,9,10 - tetranitroperylene and H₂, 2436⁷.
- C₂H₅N₂O₂ 5,6,12,13(7,14) - α - Quinacridinetetrone, dibenzamido-, 2444⁹.
- C₂H₅O₂ Perylene, 3,9-dibenzoyl-, 1351¹, 4212¹.
- C₂H₅N₂ Compd., m. 275.5° (decolor.), from benzil and *dl*-1,1'-bi[2 naphthylamine], 3698⁸.
- Compd., m. 281°, from benzil and *dl*-1,1'-bi[2-naphthylamine]-, 3698⁸.
- Compd., m. 295°, from benzil and *dl*-1,1'-bi[2-naphthylamine], 3698⁸.
- Perylenediamine, *N,N'*-dibenzal-, 2436⁷.
- C₂H₅N₂O₂ Perylene, 3,9-dibenzamido-, 4212¹.
- Perylenediamine, dibenzoyl-, 2436⁷.
- , *N,N'*-disalicylal-, 2436⁷.
- C₂H₅N₂O₂ Dibenzofluorindine, acetamidophenyl-(?), 1895⁸.
- C₂H₅Br₂N₂O₂ 2 - Naphthol, 1,1' - (2,2' - dihydro - 5,5' - dimethoxy - *s* - biphenyl)enediamine)bis-, 4456⁹.

- $C_{11}H_{11}N_2$ [1,1' - B-2 - naphthylamine], *N,N*-dibenzal-, 3698⁹.
- $C_{10}H_{11}N_2$ Compd. from reduction product of 3,1,9,10-tetranitroperylene and Bz11, 2436⁷.
- $C_{11}H_{11}O$ Acetophenone, α,α -dinaphthyl- α -phenyl-, 8341¹.
- $C_{11}H_{11}N_2O_4$ Salicylaldehyde, 5-amino-, phenyl-hydrazone, tri-Bz deriv., 1224¹.
- $C_{11}H_9$ Anthracene, 9-benzohydryl-10-benzyl-, 5183².
- $C_{11}H_9Cl_2O$ 9 - Anthrol, 10 - benzohydryl-benzyl - 1,5 - dichloro - 9,10 - dihydro -, 2172⁷.
- $C_{11}H_9O_2$ 1,2 - Ethanediol, 1,2 - dinaphthyl-1,2-diphenyl-, 833⁹, 834¹.
- $C_{11}H_9O_2$ Phenolphthalein, 3,3'-dibenzyl-, 2245¹.
- Phthalide, 2,2-bis(*p*-benzylphenoxy) -, 2215¹.
- $C_{11}H_9N_3O_2S_2$ Benzopurpurin, 1552¹, 2868⁸.
- $C_{11}H_9N_3O_2S_2$ Trypan blue, 906¹, 1173¹, 3026¹.
- $C_{11}H_9O$ 9-Anthrol, 10-benzohydryl-9-benzyl-9,10-dihydro -, 5183².
- $C_{11}H_{11}O_6$ Glucose, tetrabenzoyl-, 1391¹.
- $C_{11}H_{11}N_3O_2$ Compd., *m*. 250¹, from PhNH₂ and compd. *m* 271-2¹, 2130⁶.
- $C_{11}H_{11}N_3O_4$ 1,5 - Anthraquinone-dicarboxylic acid, 4,8 - di - *p* - tolueno-, di Et ester, 4945⁴.
- $C_{11}H_9ClFeN_3O_2$ Mesorhodin, complex Fe salt, 1414¹.
- $C_{11}H_9CuN_3O_2$ Mesorhodin, Cu salt, 1414¹.
- Mesoverdin, Cu salt, 1414¹.
- $C_{11}H_9N_3O_2$ Protoporphyrin, 2185¹.
- $C_{11}H_9N_3O_4$ Deuteroporphyrin, diacetyl-, 2185¹.
- $C_{11}H_{11}N_3O_2$ 2-Butanone, 4-*p*-anisyl-1,3-diphenyl-4-(1-pyridyl) -, picate, 5176¹.
- $C_{11}H_9N_3NiO_2$ Ketone, methyl pyridyl, oxime, N-deriv., compd. with pyridine, 4703¹.
- $C_{11}H_9O$ 9,9' Bixanthy, 9,9' dibutyl-, 3471¹.
- $C_{11}H_9O$ Compd., *m* 110¹, from homoptero-carpin and Se, 2246⁸.
- $C_{11}H_9ClFeN_3O_4$ Mesoporphyrin, Fe deriv., 1134¹ (1).
- Rhodoporphyrin, di Me ester, Fe complex, 5190¹.
- $C_{11}H_9ClN_3O_4$ New fuchsin, -HCl, hydroquinone compd., 404¹, resorcinol compd., 101¹.
- $C_{11}H_9CuN_3O_4$ Mesoporphyrin, Cu deriv., 1134¹ (1).
- Rhodoporphyrin, di Me ester, Cu complex, 5190¹, 5191¹.
- $C_{11}H_9N_3O_2$ Pseudomorphine, 1132¹.
- $C_{11}H_9N_3O_2$ Mesorhodin, and salts, 1414¹.
- Mesoverdin, and HCl, 1414¹.
- $C_{11}H_9N_3O_2$ Phylloerythrin, 4225¹.
- $C_{11}H_9N_3S$ 1,3,4 - Thiodiazolidine, 3,4 - diisoxyl-2,5-bis(isoxylimino) -, 1900¹.
- $C_{11}H_9N_3S$ Carbanilide, *p,p'* - cyclohexyldiene-bis(α -methylthio) -, 4687¹.
- $C_{11}H_9O$ Oil, dibenzyl-, 5188².
- $C_{11}H_9N_3O_4$ Mesoporphyrin, and HCl, 1134¹ (1).
- Rhodoporphyrin, di Me ester, 5190¹, 5191¹.
- Verdoporphyrin, di Me ester, 5189¹.
- $C_{11}H_9N_3O_4$ Hematoporphyrin, and di HCl, 2185¹ (1).
- $C_{11}H_9N_3O_4$ Xanthoporphinogen, 5190¹.
- $C_{11}H_9O_4$ Mucic acid, tetraacetate, ester with eugenol, 4193⁹.
- $C_{11}H_9FeN_3O_4$ Etioacetoxihemin, 5190¹.
- $C_{11}H_9CuN_3O_4$ Chlorinmonocarboxylic acid, Me ester, Cu complex, 5190¹.
- $C_{11}H_{10}N_3O_6$ Benzyl alcohol, α (α -benzylamino-ethyl)-, oxalate, 4205¹.
- $C_{11}H_{10}N_3O_6$ Benzyl alcohol, α -[α -(α -hydroxy-benzylamino)ethyl]-, oxalate, 4205⁸.
- $C_{11}H_{10}N_4$ Ethylene, tetrakis(dimethylamino-phenyl) -, P 715¹.
- $C_{11}H_{10}N_2O_4$ Lobclamine, compd with phenyl-hydrazine, 4706¹.
- $C_{11}H_{11}CuN_3O_4$ Benzyl alcohol, α -[α -(2-hydroxy-3-methoxybenzylamino)ethyl]-, Cu deriv., 4205⁸.
- $C_{11}H_{11}N_3O_4$ Chlorinmonocarboxylic acid, Me ester, 5190¹.
- $C_{11}H_{10}N_3S$ Disulfide, bis[*p,p'*-bis(dimethylamino)benzyl-], 3919¹.
- $C_{11}H_{10}O_4$ Mucic acid, tetraacetate, ester with carvacrol, 4193⁹ ester with thymol, 4193⁹.
- $C_{11}H_{10}N_3O_4$ 4:5: Indolone, 2,2',2'' - methenyl-tris[6,7 - dihydro - 3,6,6-trimethyl-, 2716¹.
- $C_{11}H_{10}N_3O_4$ Naphthamide, *N* (*N*-cetylami-no)-, 4214¹.
- $C_{11}H_{10}N_3O_4$ Phycocyanobilin, 5214².
- $C_{11}H_{10}NO_6$ Pycnoscandaocontine, 2243¹.
- $C_{11}H_{10}NO_6$ (See also *Ycontin*).
- Japacontine A, 4742¹.
- Japacontine B, 4742¹.
- $C_{11}H_{10}N_4$ Dibenzoldipiperidyl-, 4703⁶.
- $C_{11}H_{10}O$ Ergosterone, benzal-, 1647¹.
- $C_{11}H_{10}O_2$ 3-Hendecenone, 1-phenyl-, di-meride, 3696¹.
- Neostetol, benzoate, 4948¹.
- Zamostetol, benzoate, 4948⁸.
- $C_{11}H_{10}O$ Capsanthin, 1132¹.
- $C_{11}H_{10}O_2$ Ascostetol, benzoate, 4948¹.
- Fecosterol, benzoate, 4948⁸.
- $C_{11}H_{10}NO_2$ Cholestetol, *p*-aminobenzoate, and -HCl, 845¹.
- $C_{11}H_{10}NO_2$ Cholesterol, dihydro, *p*-nitrobenzoate, 845¹.
- $C_{11}H_{10}O$ Cholesterol, dihydro, benzoate, 845¹.
- $C_{11}H_{10}NO_2$ Cholesterol, dihydro, *p*-aminobenzoate, and HCl, 845¹.
- $C_{11}H_{10}N_3O_6$ Glutamic acid, *N*-[*N*:*N*:*N* [*N*:*N*-levulanylvinylallyl)glycyl]-PhNCO-deriv., 3753¹.
- $C_{11}H_{10}O_4$ Mucic acid, tetraacetate, ester with menthol, 4193⁹.
- $C_{11}H_{11}N_3O_4$ Benzyl alcohol, α -(α -heptylamino-ethyl)-, oxalate, 4205¹.
- $C_{11}H_{10}O$ Laurin, α,γ -di-, sacchylate, 4685¹.
- $C_{11}H_{10}O_2$ Capsanthin, perhydro-, 1132¹.
- $C_{11}H_{10}$ Tetratricontane, 4438¹.
- $C_{11}H_{10}O$ Isoviolanthrone, 2-methyl-, 4946¹.
- Violanthrone, 3-methyl-, 4946¹.
- $C_{11}H_{10}ClN_3O_2$ Perylenechamine, *p*-chloroben-zoylphthalyl-, 2436¹.
- $C_{11}H_{10}O$ [Bz-7-*meso*-benzanthrene]7,7'-dione, methyl-, 4946¹.
- $C_{11}H_{10}N_3O_4$ Benzamide, *N* [β,β -bis(*p*-hydroxy-phenyl)ethyl]-, dibenzoate, 3690¹.
- $C_{11}H_{10}NS$ 1 - Naphthamide, 1,4 - dihydro-1,2,4-triphenylthio -, 3920¹.
- $C_{11}H_{10}N_3S$ 1-tria-, thio-bis(4-tolylato-1-naphthyl) -, 3434¹.
- $C_{11}H_{10}O_4$ Glucoside, tetrabenzoyl-*h*-methyl-, 1391¹.
- $C_{11}H_{10}O_4$ Malonic acid, bis(*p*-benzoylbenzyl)-, di Et ester, 4942¹.
- $C_{11}H_{10}N_3NiO_2$ Ketone, methyl pyridyl, oxime, N-deriv., compd with anisole, 4703¹.
- $C_{11}H_{10}FeN_3O_4$ Phycocetoxihemin, acetate, 5190¹.

- Pyroacetoxyhemim, acetate, 5190^a.
 C₃₅H₃₇N₃O₅S Pararosaniline, hexamethyl-, 1-naphthol-4-sulfonate, 404^a.
 C₃₅H₃₇N₃O₅ Mesorhodin, Me ester, 1414^a.
 C₃₅H₃₇N₃O₅ Rhodoporphyrin, mono-Me ester, acetate, 5190^a.
 C₃₅H₃₇N₃S₂ Carbanilide, *ar, ar''*-(3-methylcyclohexylidene)bis[α -methylthio-, 4690^a.
 C₃₅H₃₇O₁₇ Phlorhizin, heptaacetyl-, 1645^a.
 C₃₅H₃₇N₃O₅ See *Ergotinine*.
 C₃₅H₃₇N₃O₅ See *Ergoloxine*.
 C₃₅H₃₇N₃O₁₆ Maltobionic acid, α -keto-, brucine salt, 3440^a.
 C₃₅H₃₇O₈ Stearin, β -mono-, dimalicylate, 4685^a.
 C₃₅H₃₇N₃O₁₁ Pseudoaconine, veratroylmethyl-, and salts, 2243^a.
 C₃₅H₃₇N₃O Urea, *s*-bis(μ - Δ^2 -cyclopentenylidodecyl)-, 114^a.
 C₃₅H₃₇O₁ Olein, γ -myristo- α -, 1110^a.
 C₃₅H₃₇ClO₄ 1,2-Propanediol, 3-chloro-, dipalmitate, 1110^a.
 C₃₅H₃₇O₁ Palmitin, α , γ -di-, 1876^a.
 C₃₅H₃₇NO Stearamide, *N*-heptadecyl-, 2419^a.
 C₃₅H₃₇ Pentatriacontane, 4438^a.
 C₃₅H₃₇N₃O₄ Urea, *s*-bis(θ -, δ -dihydroxyheptadecyl)-, 4674^a.
 C₃₅H₃₇N₃O₂ Compd., m. 293^a, from bis(β -bromobenzoyl)perylene and CuCN, 2436^a. Perylene, 3, 9-dibenzoyl-4, 10-disocyno-, 2436^a.
 C₃₅H₃₇N₃O₄ Perylenediamine, diphtalyl-, 2436^a.
 C₃₅H₃₇N₃O₄ Dinaphthacridinepentone, benzamido, P 2834^a, P 2835^a.
 C₃₅H₃₇O₂ Binaphthylene dioxide, diphtaloyl, 3450^a.
 C₃₅H₃₇N₃O₄ Naphthalimide, *N, N'*- β -biphenylenebis-, 127^a.
 C₃₅H₃₇O₂ Violanthrone, 3, 12 dimethyl-, 4945^a.
 C₃₅H₃₇O₂ [4, 4'-Bi-7-*meso*-benzanthrene]-7, 7'-dione, 9, 9'-dimethyl-, 4945^a.
 C₃₅H₃₇I₂O₂ [9, 9'-Bianthracene]-2, 2', 10, 10'-tetrol, 3, 3' - diiodo-, tetraacetate, 2173^a.
 C₃₅H₃₇O₂ Perylene, 3, 9-ditoluyl-, 3926^a, 4212^a.
 C₃₅H₃₇O₂ Perylene, 3, 9-dianisoyl-, 3926^a.
 C₃₅H₃₇M₂O₂ Chromone, 2 - styryl - *o, o'* (*m, m'* and *p, p'*) - azoxybis[3 - methyl-, 2428^a.
 C₃₅H₃₇O₂ [1, 1' - Bianthracene]tetrol, tetraacetate, 2173^a, 3464^a.
 C₃₅H₃₇CoN₃O₄ Acetophenone, β -(2-hydroxy-1-naphthylazo)-, Co deriv., 3460^a.
 C₃₅H₃₇CuN₃O₄ Acetophenone, β -(2-hydroxy-1-naphthylazo)-, Cu deriv., 3460^a.
 C₃₅H₃₇N₃ Naphthalene, 1, 8-dibenzoyl-, bis (phenylhydrazine), 3923^a.
 C₃₅H₃₇N₃IO₄ Acetophenone, β -(2-hydroxy-1-naphthylazo)-, Ni deriv., 3460^a.
 C₃₅H₃₇Cl₂PtSe₂ Tris(β -hydroxyphenyl)selenonium chloroplatinate, 2159^a.
 C₃₅H₃₇CuN₃O₂ Acetophenone, β -(2-amino-1-naphthylazo)-, Cu deriv., 3460^a.
 C₃₅H₃₇O₂Se₂ Tris(β -hydroxyphenyl)selenonium oxide, 2159^a.
 C₃₅H₃₇Se₂Tris(β -hydroxyphenyl)selenonium sulfate, 2159^a.
 C₃₅H₃₇O₁₁ Glucose, acetyltetrabenzoyl-, 1626^a, 2944^a.
 C₃₅H₃₇NSi₂ Silicane, iminobis(triphenyl-, 5470^a.
 C₃₅H₃₇ClFeN₃O₄ Porphin, 6, 7 - dipropionic acid, 1, 3, 5, 8 - tetramethyl - 2, 4 - diacetyl-, di-Me ester, Fe complex, 2185^a.
 C₃₅H₃₇CuN₃O₄ Porphin, 6, 7 - dipropionic acid, 1, 3, 5, 8 - tetramethyl - 2, 4 - diacetyl-, di-Me ester, Cu deriv., 2185^a.
 C₃₅H₃₇ClO₁₇ Monardaefin, 863^a.
 C₃₅H₃₇N₃O₄ Diphenic acid, 3, 3'-dimethoxy-, quinine acid salt, 120^a.
 C₃₅H₃₇N₃O₄ Mesorhodin, acetate, 5190^a.
 C₃₅H₃₇N₃O₄ Protoporphyrin, di-Me ester, 2185^a.
 C₃₅H₃₇N₃O₄ Porphin-6, 7-dipropionic acid, 1, 3, 5, 8 - tetramethyl - 2, 4 - diacetyl-, di-Me ester, 2185^a.
 C₃₅H₃₇N₃O₄ Rhodoporphyrin, diacetate, 5190^a.
 C₃₅H₃₇N₃O₄ Coproporphyrin, 1132^a, 1133^a, 4225^a.
 C₃₅H₃₇O₂ 9, 9' - Bixanthyl, 9, 9' - diamyl-, 3471^a.
 C₃₅H₃₇O₂ 9, 9' - Bixanthyl, 9, 9' - diisoamyl-, 3471^a.
 C₃₅H₃₇ClFeN₃O₄ Mesoporphyrin, di-Me ester, Fe deriv., 1134^a.
 C₃₅H₃₇CuN₃O₄ Mesoporphyrin, di-Me ester, Cu deriv., 1134^a.
 C₃₅H₃₇N₃O₁₀ Benzyl alcohol, α -(α -piperonyl aminoethyl)-, oxalate, 4205^a.
 C₃₅H₃₇CuO₄ γ -Pentenic acid, α -acetyl- β -p-*iso*-methyl - β - keto-, Et ester, Cu deriv., 4211^a.
 C₃₅H₃₇N₃O₄ Mesoporphyrin, di-Me ester, 1134^a, 4^a.
 C₃₅H₃₇BrFeN₃ Porphin, octaethyl-, bromohemin, 2184^a.
 C₃₅H₃₇ClFeN₃ Porphin, octaethyl-, heme, 2184^a.
 C₃₅H₃₇CuN₃ Porphin, octaethyl-, Cu deriv., 2184^a.
 C₃₅H₃₇FeN₃ Porphin, octaethyl-, iodohemin, 2184^a.
 C₃₅H₃₇MgN₃ Porphin, octaethyl-, phyllin, 2184^a.
 C₃₅H₃₇N₃O₁₀ Benzyl alcohol, α -(α -2-hydroxy-3-methoxybenzylamino)ethyl-, oxalate, 4205^a.
 Benzyl alcohol, α -(α -vanillylaminoethyl)-, oxalate, 4205^a.
 C₃₅H₃₇Br₂N₃ Compd. from octaethylporphyrin and Br, 2184^a.
 C₃₅H₃₇N₃O₅S₂ 1, 3 - Naphthylenediamine, phenyl-, dicamphorsulfonate, 4693^a.
 C₃₅H₃₇N₃ Porphin, octaethyl-, 2184^a.
 C₃₅H₃₇N₃O₄ Xanthoporphyrinogen, octaethyl-, 2185^a.
 C₃₅H₃₇N₃O₄ Coproporphyrin, tetrahydro-, 1133^a.
 C₃₅H₃₇O₁₂ Isotrihexosan, nonaacetate, 4676^a.
 C₃₅H₃₇N₃O₁₂ Pseudoaconitine, 1722^a.
 C₃₅H₃₇Cl₂O₂ Δ^1 -3 - Dodecenone, 1 - (phenylphenyl)-, dimeride, 116^a.
 C₃₅H₃₇N₃O₂S₂ Cystine, *N, N'* - bis[*N* - α -(phenylcarbamyl)leucylglycyl]-, 1588^a.
 Cystine, *N, N'* - bis[*N* - α -(phenylcarbamyl)valylalanyl]-, 1388^a.
 C₃₅H₃₇N₃O₁₂ Pseudoaconitine, 3658^a.
 C₃₅H₃₇N₃ Porphyrinogen, octaethyl-, 2184^a.
 Tetrapyrrole, tetradiethylketone, 387^a.
 —, tetramethylpropylketone-, 388^a.
 C₃₅H₃₇O₂ Δ^1 -3 - Dodecenone, 1 - phenyl-, dimeride, 116^a.
 C₃₅H₃₇N₃O₂ Δ^1 -3 - Dodecenone, 1 - phenyl-, dimeride, oxime, 116^a.
 C₃₅H₃₇N₃O₂ Artabotrine, 3530^a.
 C₃₅H₃₇O₁₁ Digitalinum verum, 843^a, 3230^a.
 C₃₅H₃₇O₁₅ Cyclamine, 3305^a.
 C₃₅H₃₇N₃O₄ Hydrazine, *s* - dichaulmoocyl-, 114^a.
 C₃₅H₃₇N₃ 1, 3, 4 - Triazole, 1 - amino - 2, 5 - bis(μ - Δ^1 -cyclopentenylidodecyl)-, 114^a.
 C₃₅H₃₇O₁₅ Pelargonic acid, (θ -hydroxy-, tri-(β -hydroxypelargonate), 3663^a.
 C₃₅H₃₇Cl₂N₃Se₂ 2896^a.

- $C_{10}H_{12}N_2O_8$ Hydrazine, *s* - bis(θ , ϵ - dihydroxy-
stearyl)-, 4674^r.
- $C_{26}H_{54}$ Hexatriacontane, 4438^r.
- $C_{27}H_{52}CuN_4Rh_2 + 5H_2O$, 2674^r.
- $C_{27}H_{28}O_{10}$ Phenolphthalein, 3' - (*ar, ar'* - di-
carboxy - *ar, ar'* - dihydroxy - *ar, ar'* -
dimethylbenzohydryl)-, 2904^r.
- $C_{27}H_{28}N_2O_8$ Phenolphthalein, 3' - [*ar, ar'* -
bis(dimethylamino)benzohydryl]-, 2963^r.
- $C_{27}H_{50}O_4$ 4 - Heptanone, 2,6 - di - 2,3 - cresyl -
2,6 - dimethyl -, dibenzoate, 2431^r.
- $C_{27}H_{26}Cl_2N_2O_4$ Crystal violet, chlorohydro-
quinone compd., 404^r.
- $C_{27}H_{26}Cl_2N_2O_4$ Crystal violet, hydroquinone
compd., 404^r; pyrocatechol compd.,
404^r; resorcinol compd., 404^r.
- $C_{27}H_{26}Cl_2N_2O_4 + 2H_2O$ Crystal violet, phloro-
glucinol compd., 404^r.
- $C_{28}H_{40}O_8$ Isosarmentogenin, dibenzoate, 2982^r.
- Sarmentogenin, dibenzoate, 2981^r.
- $C_{28}H_{32}N_2O_{10}$ Camphorgluconic acid, *p* -
hydroxy-, strychnine salt, 4208^r.
- $C_{28}H_{40}NO_8$ Pseudoaconine, monoacetylvera-
trolylmethyl-, perchlorate, 2243^r.
- $C_{28}H_{40}O_8$ Lactuceryl, benzoate, 5192^r.
- $C_{28}H_{40}O_8$ Saponin of sugar beet, 3367^r.
- $C_{28}H_{40}O_8$ Helleborein, 2501^r.
- $C_{28}H_{40}O_8$ Myristin, caprylauric, 1110^r.
- Palmitin, acetate, 1876^r.
- $C_{28}H_{40}NO_8$ Palmitin, α -glycidyl-, 4673^r.
- $C_{28}H_{32}N_2O_2$ 2 - Naphthol, 1 - (10 - 9 - anthryl
9-anthrylazo)-, 3925^r.
- $C_{28}H_{30}$ Anthracene, 9,10 - bis-phenylphenyl-,
136^r.
- $C_{28}H_{30}Br_2O$ Acetophenone, *m* and *p* - bromo -
 α - [*m* (and *p*) - bromophenyl] - α , α -
bis(*p* - phenylphenyl)-, 3922^r.
- $C_{28}H_{30}Br_2O$ Benzopinacol, *r* - 3,3' and
4,4' - dibromo - *s* - 4'',4''' - diphenyl -,
3922^r, 4.
- $C_{28}H_{30}N_2O_{10}$ 2 - Naphthoic acid, 4,4' - [*s* -
bis(*p* - nitrophenyl)ethylene]bis- - hy-
droxy-, di-Me ester, 3221^r.
- $C_{28}H_{30}O_8$ 9,10 - Anthradial, 9,10 - dihydro -
9,10 - bis(phenylphenyl)-, 136^r.
- $C_{28}H_{30}N_2O_8$ Chrysazin, 2,4,6 - tris-benzamido-
methyl-, 2173^r.
- $C_{28}H_{30}O_8$ Phenolphthalein, 3,3' - dibenzyl-,
diacetate, 2245^r.
- $C_{28}H_{30}FeN_4O_8$ Protohematin, acetate, 5190^r.
- $C_{28}H_{30}N_2O_8$ Quinoline, cyclohexylidenebis[1 -
benzoyl - 1,2,3,4 - tetrahydro -, 4688^r.
- $C_{28}H_{30}N_2O_8$ Protoporphyrin, acetate, 5190^r.
- $C_{28}H_{30}O_{10}$ Diacetyl deriv., m. 132^r, of compd
from homopterocarpin and Se, 2246^r.
- $C_{28}H_{30}FeN_4O_8$ Coproporphyrin, acetate, Fe
deriv., 1134^r.
- $C_{28}H_{30}ClFeN_4O_8$ Mesochlorohemin, acetate,
5190^r.
- $C_{28}H_{30}Cl_2O_8$ Dehydrocholic acid, di - *p* - chloro-
benzal-, 153^r.
- $C_{28}H_{30}CuN_4O_8$ Mesoporphyrin, acetate, Cu
complex, 5190^r.
- $C_{28}H_{30}N_4S_2$ Quinoline, cyclohexylidenebis-
[1,2,3,4 - tetrahydro - 1 - phenylthio-
carbonyl-, 4688^r.
- $C_{28}H_{30}N_4O_8$ Mesoporphyrin, acetate, 5190^r.
- $C_{28}H_{30}O_8$ Dehydrocholic acid, β -dibenzal-, 153^r.
- $C_{28}H_{30}FeN_4O_8$ Mesoacetoxyhemin, di-Me ester,
5190^r.
- $C_{28}H_{30}ClFeN_4O_8$ Hematoporphyrin, tetra-
methyl-, Fe salt, 5190^r.
- $C_{28}H_{30}CuN_4O_8$ Mesoporphyrin, di-Et ester, Cu
deriv., 1134^r.
- $C_{28}H_{30}N_2O_8$ Bisnomenine, 4705^r.
- Pseudobisnomenine, 4705^r.
- $C_{28}H_{30}3,7$ - Decadine, 5,6 - bis(γ , γ - dimethyl
1 - butinyl) - 2,2,9,9 - tetramethyl
5,6 - diphenyl -, 1893^r.
- $C_{28}H_{30}N_4O_8$ Mesoporphyrin, di-Et ester, 1134^r.
- $C_{28}H_{30}N_4O_8$ Mesoporphyrin, di-Et ester,
1414^r.
- $C_{28}H_{30}N_2O_8S_2$ Tetraacetyl - *d* - galactosido - 1 -
pyridinium sulfate, 3906^r.
- $C_{28}H_{30}O_8$ 4 - 3 - Dodecenone, 1 - (3,4 - methyl-
enedioxyphenyl) -, dimide, 116^r.
- $C_{28}H_{30}N_2O_{12}$ Pseudoaconine, monoacetyl, *p* -
chlorate, 2243^r.
- $C_{28}H_{30}N_2O_8$ 3,6 - Diamino - 1 - methylacri-
dinum cholate, P 612^r.
- $C_{28}H_{30}CuN_4$ Popyriole, 2 - [(3,4 - diethyl - 5 -
methyl - 2 - pyrrolmethylethyl) - 3,4 -
diethyl - 5 - methyl - Cu deriv., 2184^r.
- $C_{28}H_{30}O_8$ Galactose, heptaacetylcholosidoh
acetone -, 107^r.
- Galactose, heptaacetylcholosidoh
acetone -, 107^r.
- $C_{28}H_{30}O_8$ 4 - 3 - Dodecenone, 1 - *p* - tolyl -,
dimide, 116^r.
- $C_{28}H_{30}O_8$ Myristin, α , γ di, salicylate, 4685^r.
- $C_{28}H_{30}NO_8$ Palmitin, α -alaninide-, 4673^r.
- $C_{28}H_{30}O_8$ Stearic acid, ethylene ester, P 1417^r.
- $C_{28}H_{30}O_8$ Acetophenone, *p* - benzohydryl - α -
triphenyl-, 3696^r.
- $C_{28}H_{30}$ Ethane, 2 - (*p* - benzohydrylphenyl) - 1 -
triphenyl-, 3697^r.
- $C_{28}H_{30}N_2O_{10}$ Diphenic acid, 1,3' - dimethoxy -,
brumic acid salt, 129^r.
- $C_{28}H_{30}NO_8$ Pseudoaconine, triacetyl-
dimethyl-, 2243^r.
- $C_{28}H_{30}N_2O_8$ Pimaric acid, cinchonidine salt,
4224^r.
- $C_{28}H_{30}N_2O_8$ Protostephamine, 5272^r.
- $C_{28}H_{30}O_8P$ *d* - Glucoside, 2,3,4 - triacetyl - α -
methyl-, tri-6 phosphate, 2942^r.
- $C_{28}H_{30}O_8$ Chaulmoogra, dihydro-, di, 4676^r.
- $C_{28}H_{30}O_8$ Laurin, tri, 3676^r.
- $C_{28}H_{30}O_8$ Stearin, di, 1110^r, 1876^r.
- $C_{28}H_{30}N_2O_8$ Dibenzo γ , μ [perylene - 1,8
dione, 3,10 - bis-benzalamino-, 4130^r.
- $C_{28}H_{30}N_2O_8$ 2 - Butine, 1,4 - hexaphenyl -,
hexametro deriv., 3696^r.
- $C_{28}H_{30}N_2O_8$ Phenanthrenequinone, 2,7 - di
nitro, compd. with fluorene, 135^r.
- $C_{28}H_{30}As_2O_8$ Arsine, di - 1 - naphthyl -, oxide
2955^r.
- $C_{28}H_{30}ClN_4O_8$ Benzidine, *N, N'* - bis(5 -
chloroanil) -, dipicrate, 4456^r.
- $C_{28}H_{30}O_8$ α , α' - Stilbenediol, *p, p'* - diphenyl -
dibenzoate, 3923^r.
- $C_{28}H_{30}Sn$ Stannane, tetra - 1 - naphthyl -
1368^r.
- $C_{28}H_{30}$ 2-Butine, 1,4-hexaphenyl-, 3696^r.
- $C_{28}H_{30}O_8$ Phthalan, 1,1' - oxybis[2,2 - di
phenyl-, 1109^r.
- $C_{28}H_{30}O_{14}$ 10,10' - Banthrone, 3,3',4,4',6,6'
hexahydroxy -, hexaacetate, 2173^r.
- $C_{28}H_{30}O_8Th$ 1,3 - Butanedione, 1 - *p* - phenyl-
Th deriv., P 606^r.
- $C_{28}H_{30}FeN_4O_8$ Protoacetoxyhemin, acetate
5190^r.
- $C_{28}H_{30}FeN_4O_8$ Mesoacetoxyhemin, acetate
5190^r.
- $C_{28}H_{30}As_2ClN_4O_8$ Diguanine, chloroarsino-
393^r.
- $C_{28}H_{30}ClMnN_4O_8$ Coproporphyrin, tetra Mn
ester, Mn deriv., 1133^r.

- C₄₀H₄₆N₄O₈ Coproporphyrin, tetra-Me ester, 1133³.
- C₄₀H₄₆N₄O₁₂ Coproxanthoporphinogen, tetra-Me ester, 1134¹.
- C₄₀H₄₆N₄O₂ Quinone, compd. with *p,p'*-methylenebis[*N,N*-dimethylaniline], 2428³.
- C₄₀H₄₆N₄O₄ Quinone, compd. with bis(*p*-dimethylaminophenyl)carbinol, 2428³.
- C₄₀H₄₆O₁₁S₂ Lignosulfonic acid, 1885⁸.
- C₄₀H₄₆NO₁₄ Pseudoaconitine, diacetyl-, 2243⁸.
- C₄₀H₄₆ See *Carotene*; *Lycoprin*.
- C₄₀H₄₆O₂ Xanthophyll, 152⁷.
- Zeaxanthin, 4480⁴.
- C₄₀H₄₆O₂ Abietic anhydride, 1905⁹.
- C₄₀H₄₆N₄ Tetrapyrrole, tetraethylpropylketone-, 388¹.
- Tetrapyrrole, tetramethylbutylketone-, 388¹.
- C₄₀H₄₆O₂ Δ¹-3-Dodecenone, 1-(3,4-dimethoxyphenyl)-, dimeride, 116⁸.
- C₄₀H₄₆O₂ Xanthophyll, perhydro-, 152⁷.
- C₄₀H₄₆ Dotriacontane, 2,6,10,14,19,23,27,31-octamethyl-, 3227³.
- Lycopin, perhydro-, 3227³.
- C₄₀H₄₆KO₂ Phenolphthaleineindi-β-naphthol, mono-K deriv., 2963⁹.
- C₄₀H₄₆O₂ Phenolphthaleineindi-β-naphthol, 2963⁹.
- C₄₀H₄₆O₁₁ Glucose, β-pentabenzoyl-, 1391¹.
- C₄₀H₄₆N₄O₂ Phenolphthaleinalrhodamine, 2963⁹.
- C₄₀H₄₆O₁₄ Gitoxin, 151⁸.
- C₄₀H₄₆O₈ Laurin, α-myristodi-, 818⁹.
- Stearin, acetodi-, 1876⁸.
- C₄₀H₄₆NO₂ Palmitin, α-leucyldi-, 4673⁸.
- Stearin, α-glycyldi-, 4673⁸.
- C₄₀H₄₆ [Δ^{13,13'}-Bi-α,α'-dibenzofluorene], 1633³.
- C₄₀H₄₆O₂ Perylene, 3,9-dinaphthoyl-, 4212⁴.
- C₄₀H₄₆ [13,13'-Bi-αα'-dibenzofluorene], 1633³.
- C₄₀H₄₆N₄O₂ Perylenediamine, di-1-naphthoyl-, 2436⁸.
- C₄₀H₄₆N₄O₂ Anthracene, compd. with 2,7-dinitrophenanthrenequinone, 135⁷.
- C₄₀H₄₆ See *Rubrene*.
- C₄₀H₄₆N₄S₂ 1,3,4-Thiodiazolidine, 3,4-dinaphthyl-2,5-bis(naphthylimino)-, 1900¹.
- C₄₀H₄₆O₁₀ Phenolphthaleinojn, 2663⁴.
- C₄₀H₄₆Cl₂Compd., m. 217°, from Ph₂CClC CPh, 516⁸.
- C₄₀H₄₆Br₂O₂Se₂ Tris(5-bromo-4,3-cresyl)selenium oxide, 2159³.
- C₄₀H₄₆Cl₂ Butane, 1,4-bis[*p*-(α-chlorobenzohydryl)phenyl]-, 4943¹.
- C₄₀H₄₆O₁₀ [9,9'-Bianthracene]-2,2',10,10'-tetrol, 3,3'-diido-, tetraacetate, Me₂CO addn. compd., 2173⁴.
- C₄₀H₄₆N₄O₂ [1,1'-Binaphthalene]-2,2'-dicarboxylic acid, quinine salt, 1129⁷.
- C₄₀H₄₆O₂ Carbinol, *p,p'''*-1,4-butylenebis(triphenyl-, 4943¹.
- C₄₀H₄₆O₂ Propane, 2-methoxy-1,3-bis(triphenylmethoxy)-, 2039⁸.
- C₄₀H₄₆OSi₂ Silicic oxide, hexa-*p*-tolyl-, 2430⁴.
- C₄₀H₄₆O₂Se₂ Tricresylselenium oxide, 2159⁴.
- C₄₀H₄₆ClFeN₄O₂ Hemin, compd. with collidine, 5190⁴.
- C₄₀H₄₆O₂P₂d-Glucose, 1,2,3,4-tetraacetyl-, tri-, 6-phosphate, 2942⁴.
- C₄₀H₄₆O₂Δ¹-3-Dodecenone, 1-*p*-cumenyl-, dimeride, 116⁸.
- C₄₀H₄₆O₂ Chaulmoogric acid, phenylene ester, 2947¹, 3540².
- C₄₀H₄₆O₂ Pyrocatechol, distearate, 2161³.
- C₄₀H₄₆NO₂ Stearin, alanyldi-, 4673⁸.
- C₄₀H₄₆BrN₄O₁₀S₂ Methionic acid, bromo-, strychnine salt, 4445².
- C₄₀H₄₆N₄O₂S₂ 3-*p*-Toluenesulfonyl-2,4,6-triacetyl-β-*d*-glucosido-1-pyridinium 2,4,6-triacetyl-β-*d*-glucosido-1-sulfate, 3900³.
- C₄₀H₄₆NO₁₂ Pseudoaconitine, monobenzoyl, perchlorate, 2243⁸.
- C₄₀H₄₆O₂ Olein, caprylomyristo-, 1110⁹.
- C₄₀H₄₆O₂ Myristin, laurodi-, 818⁹, 1876⁸.
- C₄₀H₄₆N₄O₁₀ Resorcinol, 2,4,6-triphtalimido, dibenzoate, 2430².
- C₄₀H₄₆O₂ Anthraquinone, 1,1'-vinylenebis[2-hydroxy-*p*, dibenzoate, 2174¹.
- C₄₀H₄₆N₄O₂ 4-Pyrazolecarboxylic acid, 3,3'-azoxydiphenylenebis[1,5-diphenyl-, 3470¹].
- C₄₀H₄₆N₄O₂S₂ Naphthalenesulfonic acid, biphenylenedisazobis[anilino-, 1837².
- C₄₀H₄₆O₁₆ [9,9'-Bianthracene]-1,1',2,2',7,7',10,10'-octol, octaacetate, 2173⁴.
- C₄₀H₄₆N₄O₁₂ Coproporphyrin I, acetate, 5190⁴.
- C₄₀H₄₆ClFeN₄O₂ Homocoproporphyrin, tetra-Me ester, Fe deriv., 1133³.
- C₄₀H₄₆CuN₄O₂ Homocoproporphyrin, tetra-Me ester, Cu deriv., 1133³.
- C₄₀H₄₆N₄O₂ Homocoproporphyrin, tetra-Me ester, 1133³.
- Porphintetrapropionic acid, tetraethyl-, tetra-Me ester, 1133³.
- C₄₀H₄₆O₁₂ Glycyrrhizic acid, 5273⁸.
- C₄₀H₄₆N₄ Tetrapyrrole, tetraethylbutylketone-, 388¹.
- Tetrapyrrole, tetraethylisobutylketone-, 388¹.
- C₄₀H₄₆O₁₇ 6H₂O Parillin, 5473¹.
- C₄₀H₄₆O₁₀ Mesitol, α²,α³,α⁴,α⁵,α⁶-hexaphenyl-, 1633³.
- C₄₀H₄₆N₄O₂ Compd., m. 255.6° (cor.), from tetraacetylglucosypolone and aniline, 2941⁴.
- C₄₀H₄₆O₂ Laurin, steardi-, 1876⁸.
- Myristin, tri-, 818⁹, 4676⁸.
- Palmitin, caprodi-, 1876⁸.
- C₄₀H₄₆NO₂ Stearin, α-leucyldi-, 4673⁸.
- C₄₀H₄₆N₄O₂S₂ Oxanilide, *p,p'*-bis[*p*-droxynaphthylazo]phenyl]dithio-, 3414¹.
- C₄₀H₄₆O₂m-Xylene, 4,6-dimethoxy-α-hexaphenyl-, 3679⁴.
- C₄₀H₄₆FeN₄O₁₁ Coproacetoxihemin, acetat I, 5190⁴.
- C₄₀H₄₆O₂ Olein, α,γ di-, salicylate, 4685¹.
- C₄₀H₄₆O₂ Glucoside, 6-trityl-2,3,4-tris-benzoyl-β-methyl-, 2943².
- C₄₀H₄₆Cl₂O₂ Malonic acid, bis[*p*-(α-chlorobenzohydryl)benzyl], di-Et ester, 1942².
- C₄₀H₄₆O₂ Malonic acid, bis[*p*-(α-hydroxybenzohydryl)benzyl], di-Et ester, 4943¹.
- C₄₀H₄₆O₂ Myristin, palmitodi-, 1110⁹, 1876⁸.
- Palmitin, laurodi-, 1110⁹, 1876⁸.
- C₄₀H₄₆K₂N₄O₁₀ + 40H₂O, 4904⁴.
- C₄₀H₄₆Br₂O₂ 3,4,9,10-Perylenetetrol, tetakis(β-bromobenzoate), 2436³.
- C₄₀H₄₆N₄O₂ 5,6,12,13(7,14)-α-Quinacridone tetrone, bis(2-anthraquinonylamino), 2445¹.
- C₄₀H₄₆Cl₂O₂ 3,4,9,10-Perylenetetrol, di-chloro-, tetrabenzoate, 2436³.
- C₄₀H₄₆O₂ 3,4,9,10-Perylenetetrol, tetra-benzoate, 2436³.

- $C_{11}H_{15}N_3O_4$ 3,9-Perylenediamine, tetrabenzoyl-, 2436⁴.
- $C_{11}H_{15}N_3O_2$ Phenolphthaleinalphenylenediamine, 2963⁷.
- $C_{11}H_{15}As_2O$ Arsine, bis(*p* - phenylphenyl) -, oxide, 2955².
- $C_{11}H_{15}FeN_3O_4$ Malonanilide, α - cyano -, Fe deriv., 4193⁷.
- $C_{11}H_{15}O$ 1 - Naphthol, 2,4 - bis(triphenylmethyl)-, 3679⁴.
- $C_{11}H_{16}Si_4$ Cyclosilicotetrate, octaphenyl-, 2954⁸.
- $C_{11}H_{17}Cl_2O_5PtS_2$ Phenyl - *p* - phenylidenesulfonium basic chloroplatinate, 2704⁵.
- $C_{11}H_{18}O_9$ Didehydrocholic acid, 153¹.
- $C_{11}H_{17}Co_2N_2O_4$, 4905¹.
- $C_{11}H_{17}N_4$ Tetrapyrrole, tetramethylhexyl ketone -, 388³.
- $C_{11}H_{17}O_5$ Dicholanic acid, pentahydroxy -, 153¹.
- $C_{11}H_{17}HgO_4$ 1 - Hexadecene, mercuric palmitate compd., 3899⁴.
- $C_{11}H_{19}OP$ Cetyl alcohol, tri-ester with phosphoric acid, 2417¹.
- $C_{11}H_{21}O$ Palmitin, myristodi-, 1876¹.
- $C_{11}H_{17}N_4O_{12}$ Chrysazin, 2,1,5,7 - tetrakis-(phthalimidomethyl)-, 2173².
- $C_{10}H_{12}N_2O_3S_2$ Isamin blue, 910.
- $C_{10}H_{16}O_4$ Phenanthrene, 9,10 - dihydro 9,9,10,10 - tetrakis(2 - methyl 3 - indyl) -, 3465⁵.
- $C_{10}H_{16}Cl_2N_2O_3Sb_2$, 2117¹.
- $C_{10}H_{16}O_{11}$ Maltose, ditrityl-, 4675⁴.
- $C_{10}H_{16}O_2$ Hydroxy acid from soy bean, 1942⁹.
- $C_{10}H_{16}O_5$ Didehydrocholic acid, di Me ester, 153¹.
- $C_{10}H_{15}N_4O_2$ Didehydrocholic acid, di Me ester, pentoxime, 153¹.
- $C_{10}H_{17}O_8$ Hydnocarpin, dihydro -, tri-, 4676⁴.
- $C_{10}H_{17}O_8$ Stearin, α -laurodi-, 1876¹.
- $C_{10}H_{16}Na_4$ Butane, 1,1,4,4 - tetrakis phenyl phenyl-, 1,4 di Na deriv., 134.
- $C_{10}H_{17}$ Butane, 1,1,4,4 - tetrakis phenyl phenyl-, 134².
- $C_{10}H_{15}N_4O_3P_4$ Nucleic acid, 4746.
- $C_{10}H_{16}O_{13}$ Maltotetrose, tetradecaacetyl-, 377.
- $C_{10}H_{22}O_{11} + 7H_2O$ Rhamnoconvolvulic acid, 2719^{1,5}.
- $C_{10}H_{16}HgO_4$ 1 - Hexadecene, mercuric stearate compd., 3899⁴.
- $C_{10}H_{17}N_3O_9$ Emetine, cholate, P 612.
- $C_{10}H_{17}O_8$ Hydnocarpin, dihydro -, dihydro chaulmoogrodi-, 4676⁴.
- $C_{10}H_{18}O_2$ Palmitin, stearodi-, 1876¹, 2471⁸.
- $C_{10}H_{15}N_2O_8$ Dibenzol[5,6-*pe*]erylene done, 3,10 - bis(dibenzoylamino)-, 1130⁹.
- $C_{10}H_{15}N_3O_8$ Phenolphthaleinalbenzidine, 2963⁷.
- $C_{10}H_{15}N_4O_4$ Phenolphthaleinalchrysoidine, 2963⁷.
- $C_{10}H_{15}N_2$ Ergosterone, azine, 1647¹.
- $C_{10}H_{17}O_4P$ Cholesterol di-ester with phosphorous acid, 1646¹.
- $C_{10}H_{17}O_4P$ Cholesterol, di-ester with phosphoric acid, and Ba salt, 2418¹.
- $C_{10}H_{15}AsN_3O_{13}$ Alanine, *N* - (*p* - arsonophenyl) -, brucine salt, 2954⁷.
- $C_{10}H_{16}O_8$ Chaulmoogrin, dihydro, dihydro hydnocarpodi-, 4676⁴.
- $C_{10}H_{17}N_4O_4$ Phenolphthaleinalsafranine, 2963⁷.
- $C_{10}H_{17}N_2O_{11}$ Volemitol, heptaphenylcarbamate, 4192¹.
- $C_{10}H_{15}Cl_2Pt_2S_2$, 20¹.
- $C_{10}H_{15}O_{11}$ Colocynthin, 1718².
- $C_{10}H_{17}NO_3S$ Heptaacetyl - *d* - cellobiosido - 1 - pyridinium heptaacetyl - *d* - cellobiosido - 1 - sulfate, 3906⁴.
- $C_{10}H_{17}O_8$ (See also *Eleostearin*) Chaulmoogrin, 112².
- $C_{10}H_{16}O_8$ Chaulmoogrin, dihydro-, trio-, 4676⁴.
- $C_{10}H_{16}O_8$ Olein, 750¹.
- $C_{10}H_{15}O_{12}$ Anthraquinone, 1,1' - (α,β - dihydroxyethylene)bis[2 - hydroxy -, tetra-benzoate, 2174¹.
- $C_{10}H_{15}N_4O_4$ Phenanthrene, 9,9,10,10 - tetrakis(1 - acetyl - 2 - methyl - 3 - indyl) - 9,10 - dihydro-, 3865⁵.
- $C_{10}H_{12}O_8$ 4,4' - Dianthraflavone, 2712¹.
- $C_{10}H_{16}O_{12}$ Dinaphth[2,3 - α , 2,3 - θ]anthracene - 5,6,9,14,15,18 - hecane, compd with dinaphth[2,3 - α , 2,3 - θ]anthracene - 5,6,9,14,15,18 hexol, 1898¹.
- $C_{10}H_{17}N_2O_8S_2$ Pararosanine, hexamethyl, δ - amino - 1 - naphthol - 3,6 - disulfonate, 404¹.
- $C_{10}H_{15}I_2O$ Physaliene, diiodide, 3712¹.
- $C_{10}H_{16}O_4$ Physalene, 3712¹.
- $C_{10}H_{16}O_{11}$ Compd., m. 72 5 73 0°, from hydroxycaproate of α - hydroxycaproic acid, 3663³.
- $C_{10}H_{16}O_{17}$ Maltose, ditritylhexaacetyl-, 4675⁴.
- $C_{10}H_{15}N_4O_3$ Phylloporphyrin anhydride, 5190¹.
- $C_{10}H_{16}N_4O_3$ Pyrroporphyrin anhydride, 5190¹.
- $C_{10}H_{16}Br_2CoN_4OSn$ + 6H₂O, 1362¹.
- $C_{10}H_{16}Br_2MnN_4OSn$ + 2H₂O, 1362¹.
- $C_{10}H_{16}Br_2NiN_4OSn$ + 8H₂O, 1362¹.
- $C_{10}H_{16}O_4$ Camphoric acid, cholesterol ester, 2185¹.
- $C_{10}H_{16}O_9$ Juniperic acid, trijuniperate, 3664⁸.
- $C_{10}H_{16}Br_2NiN_4OSn$ + 8H₂O, 1362¹.
- $C_{10}H_{16}Br_2CoN_4OSn$ + 5H₂O, 1362¹.
- $C_{10}H_{16}Br_2MnN_4OSn$ + 1362¹.
- $C_{10}H_{16}Br_2NiN_4OSn$ + 4H₂O, 1362¹.
- $C_{10}H_{16}N_4O_2$ Rhodoporphyrin anhydride, Me ester, 5190¹.
- $C_{10}H_{12}CdCl_2N_2Ni_2$, 1363¹.
- $C_{10}H_{15}N_4O_{12}$ Diglucosylrosamine, octa-benzoate, 1626¹.
- $C_{10}H_{16}N_4O_{14}$ [1,1' - Binaphthalene] - 3,3' - dicarboxylic acid, 2,2' - dihydroxy -, prucine salt, 5182¹.
- $C_{10}H_{16}O_{11}$ Sucrose, tritrityl-, 4675⁴.
- $C_{10}H_{16}Br_2O_{12}$ Dinaphth[2,3 - α , 2,3 - θ]anthracene - 5,6,9,14,15,18 - hexol, hexa - *p* - bromobenzoate, 1898¹.
- $C_{10}H_{16}Br_2CoN_4Sn$ + 4H₂O, 1362¹.
- $C_{10}H_{16}Br_2MnN_4Sn$ + 2H₂O, 1362¹.
- $C_{10}H_{16}Br_2NiN_4OSn$, 1362¹.
- $C_{10}H_{15}NO_3S$ Tetrabenzoyl - β - *d* - glucosido - 1 - pyridinium tetrabenzoyl - β - *d* - glucosido - 1 - sulfate, 3906⁴.
- $C_{10}H_{17}O_{18}$ Raffinose, tritrityl-, 4675⁴.
- $C_{10}H_{15}O_{11}$ Desoxycholic acid, compd with Me acetate, 4926⁸.
- $C_{10}H_{15}O_{11}$ Desoxycholic acid, compd. with Et acetate, 4926⁸, compd with Me propionate, 4926⁸.
- $C_{10}H_{15}O_{16}$ Sucrose, tritritylpentaacetyl-, 4675⁴.
- $C_{10}H_{15}O_{16}$ Cholesterol, tri-ester with phosphoric acid, 2418¹.
- $C_{10}H_{16}O_{12}$ Raffinose, tritritylhexaacetyl-, 4675⁴.
- $C_{10}H_{17}O_{13}$ Desoxycholic acid, compd with Et propionate, 4926⁸, compd with Me butyrate, 4926⁸, compd with Pr acetate, 4926⁸.

- C₁₀₈H₁₇₄O₁₈ Desoxycholic acid, compd. with hexyl formate, 4926⁹.
- C₁₀₈H₁₇₄O₁₈ Desoxycholic acid, compd. with heptyl formate, 4926⁹; compd. with hexyl acetate, 4926⁹, compd. with Me enanthate, 4926⁹.
- C₁₀₈H₁₇₄O₁₈ Desoxycholic acid, compd. with heptyl acetate, 4926⁹; compd. with Me caprylate, 4926⁹.
- C₁₀₈H₁₇₄O₁₈ Desoxycholic acid, compd. with heptyl propionate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ + H₂O Gallosterol, 3490⁷.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with octyl alc., 4927¹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid⁹ compd. with Bu valerate, 4926⁹; compd. with octyl formate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with Me pelargonate, 4926⁹; compd. with octyl acetate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with Am caproate, 4926⁹; compd. with octyl propionate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with octyl butyrate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with dodecyl formate, 4926⁹; compd. with hexyl enanthate, 4926⁹; compd. with Me laurate, 4926⁹, compd. with octyl valerate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with dodecyl acetate, 4926⁹, compd. with Et laurate, 4926⁹, compd. with octyl caproate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with dodecyl propionate, 4926⁹, compd. with heptyl caprylate, 4926⁹; compd. with Me myristate, 4927¹; compd. with octyl enanthate, 4926⁹; compd. with Pr laurate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with Bu laurate, 4926⁹; compd. with dodecyl butyrate, 4926⁹, compd. with Et myristate, 4927¹, compd. with heptyl pelargonate, 4926⁹, compd. with octyl caprylate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with Bu myristate, 4927¹; compd. with hexyl laurate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with hexyl myristate, 4927¹, compd. with octyl laurate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with 1-tetradecanol, 4927¹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with tetradecyl formate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with Me pentadecanoate, 4927¹, compd. with tetradecyl acetate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with octyl formate, 4926⁹; compd. with octyl pelargonate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Apocholeic acid, compd. with cetyl acetate, 4927¹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with cetyl acetate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with cetyl propionate, 4926⁹; compd. with monyl caprate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with cetyl butyrate, 4926⁹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with tetradecyl myristate, 4927¹.
- C₁₁₂H₁₇₄O₁₈ Desoxycholic acid, compd. with cetyl myristate, 4927¹.
- CaCl₂ See Calcium chloride; *Hydrophilite*.
- CaCl₂O₂ See Calcium hypochlorite.
- CaCl₂O₃ See Calcium chlorate.
- CaF₂O₂ + 2H₂O Calcium fluophosphate, 4903⁸.
- CaF₂ See Calcium fluoride; *Fluorite*.
- CaF₂Si See Calcium fluosilicate.
- CaGeO₃ Calcium germanate, 4868⁸.
- CaHO₂P See Calcium phosphates; *Monelite*.
- CaH₂ See Calcium hydride.
- CaH₂O₂ See Calcium hydroxide.
- CaH₂O₃SiZn See *Clinohedrite*.
- CaH₂O₄P₂ See Calcium hypophosphite.
- CaH₂O₄P₂ See Calcium phosphates.
- CaI₂ See Calcium iodide.
- CaK₂O₃Si + H₂O Syngenite, 795⁹.
- CaMgO₂, 783⁴.
- CaMgO₃Si See *Monticellite*.
- CaMgO₃Si₂ See *Dioapsite*.
- CaMnO₃Si See *Glauchroite*.
- CaMn₂O₇ See Calcium permanganate.
- CaN₂O₃ See Calcium nitrate.
- CaNa₂O₃Si See *Glauberite*.
- CaO₂S See Calcium sulfite.
- CaO₂Si See *Wollastonite*.
- CaO₂Ti See *Perovskite*.
- CaO₂Zr Calcium zirconate, 1344², 3396⁷.
- CaO₃S See *Anhydrite*; *Gypsum*; *Selenite*.
- CaO₃W See Calcium tungstate, *Scheelite*.
- CaO₃SiTi See *Titanite*.
- CaO₃P₂U₂ See *Autunite*.
- CaS See Calcium sulfide, *Oldhamite*.
- CaSe Calcium selenide, 1329³.
- CaTe Calcium telluride, 1329³.
- Ca₂ClHO₂ Calcium oxychloride, 1238⁸.
- Ca₂O₃Si See *Larnite*.
- Ca₂O₃Si₂ See *Atopite*.
- Ca₂O₃Si₂Zn See *Hardystonite*.
- Ca₂O₃PbSi₂ See *Margarovite*.
- Ca₂Cr₂O₇Si₂ See *Uvarovite*.
- Ca₂Fe₂O₇Si₂ See *Andradite*.
- Ca₂Fe₂Mn₂O₇Si₂ See *Silapante*.
- Ca₂MgO₃Si₂ See *Merwinite*.
- Ca₂O₃Si + 6H₂O, 5126¹.
- Ca₂O₃P₂ See Calcium phosphates, (Ca₂O₃)₂.
- Ca₂O₃P₂ Hilgenstockite, 2679⁹.
- Ca₂H₂O₄P₂ See *Martinite*.
- Ca₂O₃P₂Si Silicocarnotite, 2679⁹.
- Ca₂H₂O₄P₂Pb₂Si₂ See *Rooblingite*.
- Ca₂Cl₂O₃P₂ See *Chlorapatite*.
- CaCl₂ See Calcium chloride.
- CaH₂O₃ Percolumbic acid, 1585².
- CaLiO₃ Lithium columbate, 1791⁴.
- CaCl₂ See Cadmium chloride.
- CaCl₂H₂O₃P₂, 575⁹.
- CaCl₂K Cadmium potassium chloride, 192².
- CaCl₂Th Cadmium thallium chloride, 267⁹.
- CaCl₂K₂, 557⁹.
- CaCl₂Na₂, 557⁹.
- CaCl₂K₂ Cadmium potassium chloride, 192².
- CaCrO₄ See Cadmium chromate.
- CaGa₂ Cadmium triiodocadmiate, 1039⁹.
- CaF₂ See Cadmium fluoride.
- CaH₂O₃ See Cadmium hydroxide.
- CaI₂ See Cadmium iodide.
- CaI₂K₂, 557⁹.
- CaI₂Na₂, 768⁹.
- CaNa₂O₃Si Cadmium sodium sulfate, 147⁹.
- CaNa₂O₃Si₂ Cadmium sodium sulfate.
- CaO See Cadmium oxide.
- CaO₂Ti Cadmium titanate, 1791⁴.
- CaO₃S See Cadmium sulfite.
- CaS See Cadmium sulfide.

- CdSb , 1094.
 $\text{Cd}_2\text{Cl}_2\text{H}_2\text{N}$, 557.
 Cd_2Sb , 1094.
 $\text{Cd}_2\text{Cl}_2\text{Li}$, Cadmium lithium chloride, 1557.
 $\text{Cd}_2\text{Cl}_2\text{Li}$, Cadmium lithium chloride, 1557.
 Cd_2P , Cadmium phosphide, 2862.
 CdCl_2 See *Cerium chlorides*.
 CeH_2O See *Cerium hydroxide*.
 CeHg , 755.
 CeO_2 See *Cerium oxide*.
 $\text{CeO}_2 + 2\text{H}_2\text{O}$ Cerium peroxide, 786.
 CeO_2S See *Cerium sulfates*.
 $\text{Ce}_2\text{O}_3\text{O}_2\text{S}$ + $8\text{H}_2\text{O}$, 5127.
 Ce_2O_3 See *Cerium oxides*.
 $\text{Ce}_2\text{O}_2\text{S}$ See *Cerium sulfates*.
 $\text{ClCoH}_2\text{N}_2\text{O}_2\text{S}$ + $3\text{H}_2\text{O}$, 5429.
 $\text{ClCoH}_2\text{N}_2\text{O}_2\text{S}$ Selenitopentamminecobaltic chloride, 1076.
 $\text{ClCoH}_2\text{N}_2\text{O}_2\text{S}$, 5429.
 $\text{ClCoH}_2\text{N}_2\text{O}_2\text{S}$ Pentammino-aquo - perchlorate sulfate, 5429.
 $\text{ClCoH}_2\text{N}_2\text{O}_2\text{S}$ Hexamminocobaltic chlorate sulfate, 5429.
 $\text{ClCoH}_2\text{N}_2\text{O}_2\text{S}$ Hexamminocobaltic perchlorate sulfate, 5429.
 $\text{ClCrH}_2\text{N}_2\text{O}_2\text{S}$, 2900.
 ClCs See *Cesium chloride*.
 ClCu See *Copper chlorides*.
 ClF See *Chlorine fluoride*.
 ClGeH_2 , 4417.
 ClH See *Hydrochloric acid*.
 ClHO See *Hypochlorous acid*.
 ClHO See *Chloric acid*.
 ClHO_2S See *Chlorosulfonic acid*.
 ClHO See *Perchloric acid*.
 ClH_2HgN , 1834, 1837.
 ClH_2N See *Chloramine*.
 ClH_2NSm , 784.
 ClH_2LiN , 789.
 ClH_2N See *Ammonium chloride*.
 ClH_2NO See *Ammonium perchlorate*.
 $\text{ClH}_2\text{N}_2\text{Sm}$, 784.
 $\text{ClH}_2\text{K}_2\text{N}_2\text{O}_2\text{Pt}$, 1581.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 1581, 1582.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 1582.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 1582.
 ClH_2LiN , 789.
 ClH_2LiN , 789.
 ClHg See *Mercury chlorides*.
 ClI See *Iodine chlorides*.
 ClK See *Potassium chloride; Sylvite*.
 ClKO See *Potassium hypochlorite*.
 ClKO See *Potassium perchlorate*.
 ClLi See *Lithium chloride*.
 ClLiO See *Lithium hypochlorite*.
 ClLiO See *Lithium chloride*.
 ClLiO See *Lithium perchlorate*.
 ClMoO See *Molybdenum oxychloride*.
 ClNO See *Nitrosyl chloride*.
 ClNO Nitryl chloride, 5429.
 ClN_2S Thionitritiazyl chloride, 3177.
 ClNa See *Sodium chloride*.
 ClNaO See *Sodium hypochlorite*.
 ClNaO See *Sodium chlorate*.
 ClNaO See *Sodium perchlorate*.
 ClO_2Ta See *Tantalum oxychlorides*.
 ClRb See *Rubidium chloride*.
 ClSn , 769.
 ClTi See *Thallium chloride*.
 ClCo See *Cobalt chloride*.
 $\text{ClCoH}_2\text{N}_2\text{O}$ + H_2O , 2900.
 $\text{ClCrH}_2\text{N}_2\text{O}$, 3311.
 ClCu See *Copper chlorides*.
 ClCuO See *Copper perchlorate*.
 $\text{ClCu}_2\text{H}_2\text{O}_2$ See *Atacamite*.
 $\text{ClCu}_2\text{O}_4 + 4\text{H}_2\text{O}$ Copper oxychloride, P 4011.
 ClFe See *Iron chlorides*.
 ClFeNO , 2885.
 $\text{ClFe}_2\text{H}_2\text{O}_2$, 28067.
 ClGe See *Germanium chlorides*.
 ClGeH_2 , 4417.
 ClHN Dichloramine, 4158.
 $\text{ClH}_2\text{HgO}_2\text{S}$, 5754.
 ClH_2OZn , 23829.
 ClH_2OSe , 1074.
 ClH_2OPb , 5754.
 ClH_2NOpt , 5427.
 ClH_2OZn , 23829.
 ClH_2HgN , 1834, 1837, 4158.
 $\text{ClH}_2\text{N}_2\text{Pt}$, 5364.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 5427.
 $\text{ClH}_2\text{N}_2\text{O}_2\text{Pt}$, 1581.
 $\text{ClH}_2\text{N}_2\text{Pt}$, 20, 5428.
 $\text{ClH}_2\text{N}_2\text{Pt}$, 5428.
 ClHgO_2 Mercury perchlorate, 5388.
 ClHgO_2Ti Double salt of HgCl_2 and TiS , 3815.
 $\text{ClK}_2\text{N}_2\text{O}_2\text{Pt}$, 1581.
 ClMg See *Bischofite*, Magnesium chloride.
 ClMgO See *Magnesium chlorate*.
 ClMgO_2 Magnesium perchlorate, 1512, 5281.
 ClMn See *Manganese chlorides*.
 ClNi See *Nickel chloride*.
 ClO See *Chlorine oxides*.
 ClOS See *Thionyl chloride*.
 ClOSE See *Selenium oxychloride*.
 ClOZr See *Zirconium oxychloride*.
 ClO_2S See *Sulfuryl chloride*.
 ClO_2Sr See *Strontium hypochlorite*.
 ClO_2Zn See *Zinc chloride*.
 $\text{ClO}_2\text{P}_2\text{Pb}$ See *Pyromorphite*.
 $\text{ClO}_2\text{P}_2\text{Sr}$ Compd of $\text{Sr}_2(\text{PO}_4)_2$ with SrCl_2 , 3876.
 ClPb See *Lead chloride*.
 ClRa See *Radium chloride*.
 ClS See *Sulfur chlorides*.
 ClS See *Sulfur chlorides*.
 ClSm See *Samarium chloride*.
 ClSn See *Tin chlorides*.
 ClSr See *Strontium chloride*.
 ClZn See *Zinc chloride*.
 ClCoH_2N_2 Trichloro-triamminocobalt, 1076.
 ClCoH_2N_2 + H_2O , 2900.
 $\text{ClCoH}_2\text{N}_2\text{O}$, 2900.
 $\text{ClCoH}_2\text{N}_2\text{O}$ Triaquo triamminocobaltichloride, 1076.
 ClCoH_2N_2 , 2900.
 $\text{ClCoH}_2\text{N}_2\text{O}$, 2900.
 $\text{ClCoH}_2\text{N}_2\text{O}$, 2900.
 ClCoH_2N_2 , 2900.
 $\text{ClCoH}_2\text{N}_2\text{O}$ + H_2O Hexamminetriol-trichlorocobaltichloride, 1076.
 $\text{ClCoCrH}_2\text{N}_2$, 350.
 ClCr See *Chromium chlorides*.
 ClCrH_2N_2 , 351, 2900.
 $\text{ClCrH}_2\text{N}_2\text{O}$, 350, 2900.
 ClCrH_2N_2 , 2900.
 ClCsHg Cesium trichloromercurate, 1030.
 ClCuH_2N Ammonium copper chloride, 4169.
 ClCuK Copper potassium chloride, 1563.
 ClEr + $6\text{H}_2\text{O}$ See *Erbium chloride*.
 ClFe See *Iron chlorides*.
 ClGa Gallium chloride, 1073.
 ClGd + $6\text{H}_2\text{O}$ See *Gadolinium chloride*.
 ClHOBu , 1580.
 ClHNSm , 784.

- Cl₂H₂HgN, 2344¹.
 Cl₂H₂N₂Sm, 784⁹.
 Cl₂H₂N₂O₂Pt, 1583¹.
 Cl₂H₂N₂O₂Pt, 1581¹, 1583¹.
 Cl₂H₂N₂Sm, 784⁹.
 Cl₂H₂N₂O₂Pt, 1581¹, 1583¹.
 Cl₂H₂N₂Rh, 4217³.
 Cl₂H₂N₂Sm, 784⁹, 4139⁹.
 Cl₂H₂N₂Sm, 784⁹, 4139⁹.
 Cl₂H₂N₂Sm, 784⁹.
 Cl₂HgK, 2344¹.
 Cl₂HgNa, 2344¹.
 Cl₂HgTl, Mercury thallium chloride, 2671⁴.
 Cl₂I See Iodine chlorides.
 Cl₂I₂Na₂O₂ + 10H₂O, 3306⁹.
 Cl₂KMg, + 6H₂O See Carnallite.
 Cl₂La See Lanthanum chloride.
 Cl₂N See Nitrogen chloride.
 Cl₂Nd See Neodymium chloride.
 Cl₂OP See Phosphorus oxychloride.
 Cl₂OTa See Tantalum oxychlorides.
 Cl₂O₂Pr Praseodymium perchlorate, 4140⁹.
 Cl₂P See Phosphorus chlorides.
 Cl₂Ru See Ruthenium chlorides.
 Cl₂Sb See Antimony chlorides.
 Cl₂Sm See Samarium chlorides.
 Cl₂Ti See Titanium chloride.
 Cl₂U See Uranium chlorides.
 Cl₂CoLi, 744⁹.
 Cl₂Cr₂H₂N₂O₂S₂, 2900².
 Cl₂CuH₂N₂, 1034⁹.
 Cl₂CuK₂ (See also Mitscherlichite).
 Copper potassium chloride, 1563¹.
 Cl₂Ge See Germanium chlorides.
 Cl₂HI + 4H₂O Chloriodous acid, 4633⁹.
 Cl₂H₂O₂Se, 1074⁷.
 Cl₂H₂HgN, 2344¹.
 Cl₂H₂N₂O₂Pt, 5428².
 Cl₂H₂N₂O₂Pt, 1582⁹.
 Cl₂H₂N₂O₂Pt, 1582⁹.
 Cl₂H₂N₂O₂Pt, 1582⁹.
 Cl₂HgK, 2344¹.
 Cl₂HgNa, 2344¹.
 Cl₂K₂Pt Potassium chloroplatinate, 1581¹, 3390⁹.
 Cl₂Mn₂O₂Si₂ + 4H₂O See Friedelite.
 Cl₂Ru See Ruthenium chlorides.
 Cl₂S See Sulfur chlorides.
 Cl₂Se See Selenium chlorides.
 Cl₂Si See Silicon tetrachloride.
 Cl₂Sn See Tin chlorides.
 Cl₂Te See Tellurium chlorides.
 Cl₂Th See Thorium chloride.
 Cl₂Ti See Titanium chloride.
 Cl₂Th₂Zn Thallium zinc chloride, 2671⁴.
 Cl₂U See Uranium chlorides.
 Cl₂Zr See Zirconium chloride.
 Cl₂FeK₂ + H₂O Iron potassium chloride, 3180⁹.
 Cl₂FeH₂O₂P, 575⁹.
 Cl₂MgTl Magnesium thallium chloride, 2671⁴.
 Cl₂P See Phosphorus chlorides.
 Cl₂Ta See Tantalum chloride.
 Cl₂Th₂Zn Thallium zinc chloride, 2671⁴.
 Cl₂Co₂H₂N₂O₂ + 2H₂g Dodecammine-hexol-tetra-cobalt-chloride, 1076⁹.
 Cl₂FeH₂Na See Rinnesite.
 Cl₂H₂Pt See Chloroplatinic acid.
 Cl₂H₂Hg₂O₂P, 575⁹.
 Cl₂H₂O₂Si₂P, 575⁹.
 Cl₂H₂O₂P₂Pb, 575⁹.
 Cl₂H₂N₂O₂P, 575⁹.
 Cl₂H₂N₂O₂Rh, 4415⁹.
 Cl₂K₂Pt See Potassium chloroplatinate.
 Cl₂Re See Rhenium chlorides.
 Cl₂H₂N₂O₂Pt₂S, 5425¹.
 Cl₂H₂N₂Sm₂, 784⁹.
 Cl₂H₂O₂Si₂Tl Double salt of HgCl₂ and Tl₂SO₄, 3845¹.
 Cl₂O₂P₂Sn, 5362⁹.
 Cl₂O₂Ti Titanium oxychloride, 1586¹.
 Cl₂Pr₂Pt Praseodymium chloroplatinate, 4140⁹.
 CoCrO₂ See Cobalt chromate.
 CoCr₂H₂N₂Na₂O₂ Potassium dichromatotetramminecobaltate, 3180⁹.
 CoCr₂H₂LiN₂O₂ Lithium dichromatotetramminecobaltate, 3180⁹.
 CoCr₂H₂N₂Na₂O₂ Sodium dichromatotetramminecobaltate, 3180⁹.
 CoCr₂O₂ Cobalt chromite, 2385⁹.
 CoF₂ See Cobalt fluorides.
 CoF₃ See Cobalt fluorides.
 CoFe₂O₂, 1031¹, 2385⁹.
 CoH₂O₂ See Cobalt hydroxide.
 CoH₂O₂ See Cobalt hydroxides.
 CoH₂N₂O₂, 2900².
 CoH₂N₂O₂, 2899⁹.
 CoH₂N₂O₂S + 2H₂O, 2900².
 CoH₂N₂O₂, 2900².
 CoH₂I₂N₂O₂, 1361⁴.
 CoH₂N₂O₂, 2899⁹.
 CoH₂I₂N₂O₂, 1361⁴.
 CoK₂O₂S₂ + 6H₂O, 1434⁹, 1616⁸.
 CoK₂O₂S₂ + 6H₂O Potassium trisulfocobaltate, 2898⁹.
 CoLi₂O₂S₂ + 4H₂O Lithium trisulfocobaltate, 2898⁹.
 CoMo, 2348⁹.
 CoN₂O₂ See Cobalt nitrate.
 CoN₂Na₂O₂ Sodium cobaltnitrite, 3109, 772, 5414³.
 CoNa₂O₂S₂ 4H₂O Cobalt sodium sulfate, 3149⁹.
 CoNa₂O₂S₂ 4H₂O Sodium trisulfocobaltate, 2898⁹.
 CoO See Cobalt oxides.
 CoO₂Sn See Cobalt stannate.
 CoO₂S See Cobalt sulfate.
 CoO₂Se See Cobalt selenate.
 CoO₂W See Cobalt tungstate.
 CoS See Cobalt sulfide.
 CoCr₂H₂MgN₂O₂ Magnesium dichromatotetramminecobaltate, 3180⁹.
 CoFe₂O₂, 1031¹.
 CoH₂Na₂O₂S₂ + 9H₂O, 1634⁹.
 CoH₂N₂O₂S₂, 2900².
 CoH₂N₂O₂, 4158⁹.
 CoH₂N₂O₂Se₂ + 3H₂O Selenotetramminecobaltic selenite, 1076⁹.
 CoH₂N₂O₂S₂, 2900².
 CoH₂N₂O₂S₂, 2900².
 CoH₂N₂O₂S₂ + 4H₂O, 2900².
 CoMo₂, 2348⁹.
 CoO₂ See Cobalt oxide.
 CoO₂Sn Cobalt orthostannate, 464⁹.
 CoO₂Zn See Zinc cobaltite.
 CoO₂S₂ See Cobalt sulfates.
 CoO₂ See Cobalt cobaltite, Cobalt oxide.
 Co₂Si See Linnite.
 CoCr₂H₂LiN₂, 350⁹.
 CoCo₂S₂ + 12H₂O See Alum.
 CoCuO₂ See Copper chromate.
 CrF₃ See Chromium fluoride.
 CrF₃ See Chromium fluorides.
 CrH₂O₂ See Chromic acid.
 CrH₂O₂ See Chromium hydroxide.
 CrH₂NO₂P₂ + 5H₂O Ammonium chromophosphate, 1584⁷.
 CrH₂NO₂S₂ + 12H₂O See Alum.
 CrH₂NO₂S₂ + 12H₂O See Alum.

- $\text{CrH}_2\text{NO}_3\text{S}_2 + 12\text{H}_2\text{O}$ See *Alums*.
 $\text{CrH}_2\text{N}_2\text{O}_3$, 3509.
 $\text{CrH}_2\text{N}_2\text{O}_3$, 2900¹.
 $\text{CrH}_2\text{N}_2\text{O}_3$, 3509, 2900^{1,2}.
 $\text{CrH}_2\text{N}_2\text{O}_3$, 2900².
 $\text{CrH}_2\text{N}_2\text{O}_3$, 3509, 2900².
 CrKO_3S_2 See *Alums*.
 $\text{CrKO}_3\text{S}_2 + 12\text{H}_2\text{O}$ See *Alums*.
 CrK_2O_3 See *Potassium chromate*.
 CrMgO_3 See *Magnesium chromate*.
 CrN Chromium nitride, 4177, 5143³.
 CrO_3Pb See *Crocoite*; *Lead chromate*.
 CrO_3Zn See *Zinc chromate*.
 $\text{CrO}_3\text{RbS}_2 + 12\text{H}_2\text{O}$ See *Alum*.
 $\text{CrO}_3\text{RbS}_2 + 12\text{H}_2\text{O}$ See *Alums*.
 $\text{CrO}_3\text{S}_2\text{Ti} + 12\text{H}_2\text{O}$ See *Alums*.
 $\text{CrO}_3\text{S}_2\text{Ti} + 12\text{H}_2\text{O}$ See *Alums*.
 Cr_2FeO_3 See *Chromite*.
 $\text{Cr}_2\text{H}_2\text{O}_3$ See *Dichromic acid*.
 $\text{Cr}_2\text{H}_2\text{N}_2\text{O}_3$ See *Ammonium dichromate*.
 $\text{Cr}_2\text{K}_2\text{O}_3$ See *Potassium dichromate*.
 Cr_2NiO_3 Nickel chromite, 2385.
 Cr_2O_3 See *Chromium oxide*.
 $\text{Cr}_2\text{O}_3\text{Sb}_2$ Antimony chromate, 2382.
 $\text{Cr}_2\text{O}_3\text{Sb}_2$ See *Chromium sulfate*.
 $\text{Cr}_2\text{O}_3\text{Sb}_2$ Antimony chromate, 2382.
 $\text{Cr}_2\text{Fe}_2\text{O}_3 + \text{H}_2\text{O}$ Iron chromite, 2382.
 $\text{Cr}_2\text{O}_3\text{Zr}_2 + 12\text{H}_2\text{O}$ Zirconium chromate.
 $\text{CsF}_2\text{O}_3\text{P}$ Cesium difluorophosphate, 4634.
 CsHg_2 Cesium triiodomercurate, 1040.
 CsI See *Cesium iodide*.
 CsIO_3 See *Cesium iodate*.
 CsNO_3 See *Cesium nitrate*.
 Cs_2O_3 See *Cesium sulfate*.
 CuF See *Copper fluoride*.
 CuFeS_2 See *Chalcocopyrite*.
 CuFe_2S_3 See *Cubanite*.
 CuH_2O_3 See *Copper hydroxide*.
 $\text{CuH}_2\text{O}_3\text{Si}$ See *Diopside*.
 $\text{CuH}_2\text{O}_3\text{Sn}$ Copper stannate, 3147.
 $\text{CuH}_2\text{N}_2\text{O}_3\text{P}_2 + 4\text{H}_2\text{O}$ Ammonium copper phosphate, 1584.
 CuI See *Copper iodide*.
 CuMg , 5873, 3426¹.
 CuMn_2O_3 See *Reductite*.
 CuN_2O_3 See *Copper nitrate*.
 CuNaO_3S_2 Copper sodium thiosulfate, 4547.
 $\text{CuNa}_2\text{O}_3\text{S}_2 + 2\text{H}_2\text{O}$ Copper sodium sulfate, 3149.
 CuO See *Copper oxides*; *Tenaxite*.
 CuO_3Si See *Chrysocolla*; *Tenaxite*.
 CuO_3Sn See *Copper stannates*.
 CuO_3S See *Chalcantite*; *Copper sulfate*.
 CuO_3Se See *Copper selenate*.
 $\text{CuO}_3\text{P}_2\text{U}_2 + 4\text{H}_2\text{O}$ See *Torbenite*.
 CuS See *Copper sulfides*; *Covellite*.
 CuS_2Sb_2 See *Chalcantite*.
 CuSe See *Alochmannite*.
 CuZn_2 , 5138.
 CuFeS_2Sn See *Stannite*.
 CuHO_3P See *Lithaenite*.
 $\text{Cu}_2\text{K}_2\text{O}_3\text{S}_2 + 2\text{H}_2\text{O}$ Copper potassium thiosulfate, 1075.
 Cu_2Mg , 5873, 3426¹.
 Cu_2O See *Chalcocite*; *Copper oxide*.
 $\text{Cu}_2\text{O}_3\text{Si}$ Copper silicate, 2642.
 $\text{Cu}_2\text{O}_3\text{S}$ See *Copper sulfates*.
 Cu_2PbS_2 See *Zingite*.
 $\text{Cu}_2\text{Pb}_2\text{S}_2\text{Sb}_2$ See *Bourbonite*.
 Cu_2S See *Chalcocite*; *Copper sulfides*.
 Cu_2Sb Copper antimonide, 5370.
 Cu_2Se See *Berzianite*; *Copper selenide*.
 Cu_2Te See *Copper telluride*.
 $\text{Cu}_2\text{O}_3\text{V}$ See *Copper vanadate*; *Uzbekite*.
 $\text{Cu}_2\text{S}_2\text{V}$ See *Sulvanite*.
 Cu_2Sb , 1544.
 Cu_2Se See *Umgangite*.
 Cu_2Sn , 5875, 1544, 1608, 3889.
 Cu_2Sn_2 , 1608.
 $\text{Cu}_2\text{H}_2\text{O}_3\text{S}$ See *Brochantite*.
 Cu_2Sn , 1608, 3889.
 Cu_2Zn_2 , 5875.
 Cu_2Sn_2 , 5875.
 Dy_2O_3 See *Dysprosium oxide*.
 Er_2O_3 See *Erbium oxide*.
 $\text{Er}_2\text{O}_3\text{S}_2 + 8\text{H}_2\text{O}$ Erbium sulfate, 5360.
 Eu_2O_3 See *Eurobium oxide*.
 FH See *Hydrofluoric acid*.
 FHOP Fluorophosphoric acid, 4903, 5393.
 FHN See *Ammonium fluoride*.
 FHNOP Ammonium fluophosphate, 4903.
 FHO-P Mercury fluophosphate, 4903.
 FK See *Potassium fluoride*.
 FKOP Potassium fluophosphate, 4903.
 FLi See *Lithium fluoride*.
 FMg See *Magnesium fluoride*.
 FNO Nitryl fluoride, 5014.
 FNa See *Sodium fluoride*.
 FOSm See *Samarium oxyfluoride*.
 FOPPb Lead fluophosphate, 4903.
 FOFSr Strontium fluophosphate, 4903.
 FSr See *Strontium fluoride*.
 FFe See *Iron fluorides*.
 FHNa See *Sodium fluoride*.
 FHOP Difluorophosphoric acid, 4631.
 FHNOP Ammonium difluorophosphate, 1631.
 FKOP Potassium difluorophosphate, 4634.
 FMg See *Magnesium fluoride*.
 $\text{FMg}_2\text{O}_3\text{Si}$ See *Norbergite*.
 FMn See *Manganese fluoride*.
 FNi See *Nickel fluoride*.
 FO See *Fluoric oxide*.
 FPb See *Lead fluoride*.
 FZn See *Zinc fluoride*.
 FFe See *Iron fluorides*.
 FHMnN Ammonium manganese fluorosulfate, 1869.
 FKMn Manganese potassium fluoride, 3869.
 FLaOP Lanthanum fluophosphate, 4903.
 FMnNa Manganese sodium fluoride, 3869.
 FN Nitrogen trifluoride, 5011.
 FNd See *Niobium fluoride*.
 FOP See *Phosphoric oxyfluoride*.
 FP See *Phosphorus fluorides*.
 FRh Rhodium fluoride, 5014.
 FSm See *Samarium fluoride*.
 FIr See *Iridium fluoride*.
 FIrO Iridium oxyfluoride, 3869.
 FRh Rhodium fluoride, 5014.
 FS See *Sulfur tetrafluoride*.
 FSi See *Silicon tetrafluoride*.
 $\text{FHN}_2\text{O}_3\text{Ti}$ Ammonium peroxotitanyl fluoride, 780.
 FRh Rhodium fluoride, 5014.
 FHSi See *Silicofluoric acid*.
 FHN_2Si Ammonium fluosilicate, P 17.
 FI See *Iridium fluoride*.
 FMgSi See *Magnesium fluosilicate*.
 FNaSi See *Sodium fluosilicate*.
 FK-Ta Potassium fluorantimonate, 3425.
 $\text{FFeO}_3\text{S}_2\text{Si}_2\text{Br}_2 + 15\text{H}_2\text{O}$, 2672.
 FeHO See *Goethite*.
 FeHO_3P , 2885.
 FeH_2O_3 See *Iron hydroxide*.
 $\text{FeH}_2\text{N}_2\text{O}_3$, 3869.

- FeH₂O₃** See *Iron hydroxides*.
FeH₂NO₃ See *Alums*.
FeH₂N₂O₈ · 6H₂O Ammonium iron sulfate, 2828⁹.
FeI₂ See *Iron iodides*.
FeKN₂O₈ · 3H₂O, 3869⁹.
FeK₂N₂O₁₁ · 4H₂O, 4614⁷.
FeLi₂N₂, 788⁹.
FeMo, 5138⁹.
FeNO₃, 2885⁹, 3869⁹.
FeN₂O₃ See *Iron nitrates*.
FeN₂O₄ Iron tetranitrosyl, 3869⁹.
FeNaO₂Si₂ See *Argirite*.
FeNa₂O₂Si₂ · 2H₂O Iron sodium sulfate, 3149⁹.
FeNa₂O₂Si₂ Iron sodium sulfate, 3149⁹.
FeO See *Iron oxides*.
FeO₂Ti See *Ilmenite*.
FeO₂P See *Iron phosphates*.
FeO₂S See *Iron sulfate*; *Melanterite*.
FeO₂W See *Iron tungstates*; *Wolframite*.
FeS See *Iron sulfides*; *Troilite*.
FeS₂b See *Gudmundite*.
FeS₂ See *Iron sulfides*; *Marcasite*; *Pyrite*.
FeS₂sb See *Berthierite*.
FeS₂b See *Iron antimonides*.
FeS₂b See *Iron antimonides*.
FeZn₂, 2138⁹.
Fe₂MgO₄ Magnesium ferrite, 3065².
Fe₂Mo₂O₇ Iron molybdate, 4868⁹.
Fe₂N See *Iron nitrides*.
Fe₂NiO₄ Nickel ferrite, 2385⁹.
Fe₂O₃ See *Goethite*; *Hematite*; *Iron oxides*; *Lepidocrocite*; *Martite*; *Specularite*.
Fe₂O₂Si See *Fayalite*.
Fe₂O₂Zn Zinc ferrite, 4914³.
Fe₂O₂Si₂ See *Nontzonite*.
Fe₂O₂Si₂ See *Iron sulfates*.
Fe₂P See *Iron phosphides*.
Fe₂Mo₂, 5138⁹.
Fe₂O₂ See *Magnetite*.
Fe₂O₂P₂ See *Iron phosphates*.
Fe₂P See *Iron phosphides*.
Fe₂Zn₂, 2138⁹.
Fe₂KN₂O₈ · 3H₂O, 3869⁹.
Fe₂N See *Iron nitrides*.
Fe₂O₂Si₂ · 2H₂O See *Anthosiderite*.
Fe₂O₂sb₂Ti₂ See *Derbyite*.
GaH₂O₃ See *Gallium hydroxide*.
Ga₂H₂N₂O₈Si₂ · 16H₂O, 5425⁹.
Gd₂O₃ See *Gadolinium oxide*.
GeI₂ See *Germanium iodides*.
GeI₂ See *Germanium iodides*.
GeO₂ See *Germanium oxides*.
GeO₂Br Strontium germanate, 4868⁹.
H₂ See *Mercury hydride*.
HI See *Hydriodic acid*.
HIO See *Hypoiodous acid*.
HIO₃ See *Iodic acid*.
HI₂ Hydrogen triiodide, 3391⁴.
HK See *Potassium hydride*.
HKO See *Potassium hydroxide*.
HKO₂ See *Potassium sulfates*.
HL₂ See *Lithium hydride*.
HLiO See *Lithium hydroxide*.
HMg See *Magnesium hydride*.
HMgO₂P · 2H₂O See *Newberyite*.
HMnO₂ See *Manganite*.
HMnO₂ Perthiomoxylic acid, 4156⁹.
HNO₂ See *Nitrous acid*.
HNO₃ (See also *Nitric acid*.)
HNO₃ Pernitrous acid, 3170⁹.
HNO₃ See *Pernitric acid*.
HNO₂S Nitrosylsulfuric acid, 320⁹, 2384⁹.
HN See *Hydrazoic acid*.
HN₂O See *Sodium hydroxide*.
HN₂O₂Sn Sodium stannite, P 3084¹.
HN₂O₂S See *Sodium sulfites*.
HN₂O₂S See *Sodium sulfates*.
HN₂S See *Sodium hydrosulfide*.
HN₂O₂P See *Sodium phosphates*.
HO₂Tl See *Thallium hydroxide*.
HO₂P See *Metaphosphoric acid*.
HO₂V See *Vanadic acid*.
HO₂Pr See *Strontium phosphates*.
HO₂Be Perrhenic acid, 1833⁹, 4632⁹.
HO₂Ta Pertantallic acid, 1585⁹.
HPd See *Palladium hydrides*.
HPd₂ See *Palladium hydrides*.
H₂HgO₂ See *Mercury hydroxides*.
H₂KN See *Potassium amide*.
H₂KO₂P See *Potassium phosphates*.
H₂MgO₂ See *Magnesium hydroxide*.
H₂MgO₂Si₂ See *Magnesium sulfate*.
H₂MnO₂ See *Manganese hydroxides*.
H₂MnO₂Si₂Zn₂ See *Hodgkinsonite*.
H₂MnO₂Pb See *Cesarite*.
H₂MnO₂Zn₂ See *Hetaerolite*.
H₂MoO₂ See *Molybdic acid*.
H₂NaO₂P See *Sodium phosphates*.
H₂Ni See *Nickel hydride*.
H₂NiO₂ See *Nickel hydroxide*.
H₂O See *Water*.
H₂O₂ See *Hydrogen peroxide*.
H₂O₂Pb See *Lead hydroxide*.
H₂O₂Pr See *Strontium hydroxide*.
H₂O₂Ti See *Titanium hydroxide*.
H₂O₂Zn See *Zinc hydroxide*.
H₂O₂P See *Hypophosphoric acid*.
H₂O₂S See *Sulfurous acid*.
H₂O₂Si₂ See *Thiosulfuric acid*.
H₂O₂Se See *Selenious acid*.
H₂O₂Sn See *Stannic acid*.
H₂O₂Ti See *Titanic acid*.
H₂O₂S See *Sulfuric acid*.
H₂O₂Si₂ See *Hyposulfurous acid*.
H₂O₂Se See *Selenic acid*.
H₂O₂To Telluric acid, 1077¹.
H₂O₂W See *Tungstic acid*.
H₂O₂Si₂Zn₂ See *Calamine*.
H₂O₂Si₂ See *Dithionic acid*.
H₂O₂Si₂ See *Trithionic acid*.
H₂O₂Si₂ See *Tetrathionic acid*.
H₂O₂Si₂ See *Pentathionic acid*.
H₂O₂Si₂ See *Persulfuric acid*.
H₂S See *Hydrogen sulfide*.
H₂S₂ Hydrogen pentasulfide, 572⁹.
H₂Si₂Th₂V₂ · 18H₂O, 1586⁹.
HN See *Ammonia*.
HNO See *Hydroxylamine*.
HNO₂S See *Sulfamic acid*.
H₂N₂O₂Pb Lead nitrate, monoammon. (c. 4962)⁹.
H₂NdO₂ See *Neodymium hydroxide*.
H₂NdO₂P₂ Neodymium phosphate 4130⁹.
H₂NiO₂ See *Nickel hydroxides*.
H₂O₂P See *Hypophosphorous acid*.
H₂O₂P See *Phosphorus acid*.
H₂O₂Pr See *Praseodymium hydroxide*.
H₂O₂sb See *Antimony hydroxide*.
H₂O₂P See *Phosphoric acid*.
H₂O₂P₂Pr Praseodymium phosphite, 4140⁹.
HP See *Phosphine*.
HN See *Ammonium iodide*.
H₂KO₂P Addn. compd. of KH₂PO₄, 1110⁹.
H₂MgNO₂P · 6H₂O Ammonium phosphate, 5420⁹, 5584⁹.

- $H.Mg_2O_3Si$ See *Sepiolite*.
 $H.Mg_2O_3Si$ See *Chrysotile*; *Serpentine*.
 $H.MnNO_3$ See *Ammonium permanganate*.
 $H.NNaO_3S + 2H_2O$ Ammonium sodium sulfate, P 4782².
 $H.NO_3P$ (See also *Ammonium metaphosphate*.)
 Amidophosphoric acid, 877¹.
 $H.NO_3Se$ Ammonium perhenate, 4632².
 $H.NO_3V$ Ammonium vanadium sulfate, 1583⁶.
 $H.NSV + 2H_2O$, 1586⁴.
 $H.N$; See *Hydrazine*.
 $H.N_2O_3$ See *Ammonium nitrate*.
 $H.N.NdO_3$ Ammonium neodymium nitrate, 2104¹.
 $H.O_3Si$ See *Orthosilicic acid*.
 $H.O_3Sn$ See *Tin acids*.
 $H.O_3Th$ See *Thorium hydroxide*.
 $H.O_3Zr$ See *Zirconium hydroxide*.
 $H.O_3P_2$ See *Hypophosphoric acid*.
 $H.O_3P_2$ See *Pyrophosphoric acid*.
 $H.O_3P_2Sr$ Strontium phosphate, 2642⁴.
 $H.O_3SiW_9 + 4H_2O$ Silicotungstic acid, 2336⁵.
 $H.O_3SiW_{10} + 5H_2O$ Silicotungstic acid, 2336⁵.
 $H.O_3SiW_{11}$ Silicotungstic acid, 2336⁵.
 $H.Th$ See *Thorium hydride*.
 $H.KNO_3P$ Ammonium potassium phosphate, P 4306².
 $H.MnNO_3P_2$, 785¹.
 $H.NO$ See *Ammonium hydroxide*.
 $H.NO_3S$ See *Ammonium sulfites*.
 $H.Na_2O_3P$ Addn. compd. of Na_2HPO_4 and H_2O , 2114¹.
 $H.N.O$ Hydrazine, hydrate, 3664⁵.
 $H.N.O.PbS$ Lead sulfate, diammonate, 4902².
 $H.N.O_3Se$ Hydrazine selenate, 787¹.
 $H.N.O.Pt$, 1582².
 $H.N.O.Pt$, 1582².
 $H.N.O.Pt$, 1582².
 $H.Na_2O_3Sn$ Sodium stannate, 3147¹.
 $H.NiO_3Sn$ Nickel stannate, 3147¹.
 $H.O_3Si$, 1036⁴.
 $H.O_3P.Pt$ Praseodymium hypophosphite, 4140¹.
 $H.O_3Si$ See *Pyrosilicic acid*.
 $H.O_3Si.W_{11} + 4H_2O$ Silicotungstic acid, 2336⁵.
 $H.KNO_3P$ Ammonium potassium phosphate, P 4027².
 $H.MoN_3Se$ Ammonium selenomolybdate, 1586³.
 $H.MoN_3Sn$ Ammonium perthiomolybdate, 4156⁷.
 $H.N.Na_2O_3P_2 + 7H_2O$ Ammonium sodium hypophosphate, 1584⁴.
 $H.N.O_3S$ See *Ammonium sulfites*.
 $H.N.O_3S$ See *Ammonium sulfate*.
 $H.N.O_3S_2$ See *Ammonium persulfate*.
 $H.N.O_3S$ Isomonoisulphohydroxylamine sulfate, 2372¹.
 $H.N_3S$ Ammonium polysulfide, 572².
 $H.N_3S$ Ammonium polysulfide, 572².
 $H.N.NdO_3$ Ammonium neodymium nitrate, 4139¹.
 $H.N.O_3Pt$ Ammonium praseodymium nitrate, 4140¹.
 $H.O_3Si$, 1585².
 $H.O_3SiW_{11} + 4H_2O$ Silicotungstic acid, 5428⁵.
 $H.N.O_3P$ See *Ammonium phosphates*.
 $H.N.O_3Pb$ Lead nitrate, triammonate, 4902².
 $H.N.O_3S$, 1045⁵.
 $H.K.O_3P$ Addn. compd. of K_2HPO_4 and H_2O , 2114¹.
 $H.N.O_3P$ See *Ammonium phosphates*.
 $H.N.O_3V$ See *Ammonium vanadate*.
 $H.N.O_3PbS$ Lead sulfate, tetrammonate, 4902².
 $H.N.NiO_3$, 4156⁷.
 $H.N.O_3P_2$ See *Ammonium pyrophosphate*.
 $H.N.N_3V_2$ Ammonium perthiovanadate, 4156⁷.
 $H.N.O_3Pt_2S$, 1582².
 $H.N.Na_2O_3Pt_2S$, 1582².
 $H.N.Na_2O_3S$, 1045⁵.
 $H.N.Na_2S_2V_6 + 18H_2O$, 1586⁴.
 $H.N.Na_2O_3Pb$ Lead nitrate, hexammonate, 4902².
 $H.N.Mo.Na_2O_3Te + 7H_2O$ Ammonium molybdotellurate, 1836¹.
 $H.N.Mo.Na_2O_3Te_2 + 10H_2O$ Ammonium molybdotellurate, 1836¹.
 $H.N.Na_2O_3S$, 1045⁵.
 $H.N.Na_2O_3S$, 1045⁵.
 $H.K_2O_3S_2 + 3H_2O$ Potassium peroxohafnium sulfate, 786².
 HgI See *Mercury iodides*.
 HgI See *Mercury iodides*.
 $HgI.K$ Mercury potassium iodide, 2384⁵, 3946⁷.
 $HgI.K$ Mercury potassium iodide, 4909¹.
 $HgNa$, 755⁹.
 $HgNa$, 755⁹.
 HgO See *Mercury oxides*.
 $HgPd$ See *Polarite*.
 HgS See *Cinnabar*; *Mercury sulfide*.
 $HgSe$ See *Tiemannite*.
 $HgTI$, 768².
 HgI See *Mercury iodides*.
 $HgI.K$ Mercury potassium iodide, 2384⁵.
 $HgNa$, 755⁹.
 $HgNa$, 755⁹.
 HgO See *Mercury oxides*.
 $HgO.S$ See *Mercury sulfate*.
 $HgNa$, 755⁹.
 $HgTI$, 755⁹.
 $HgNa$, 755⁹.
 HgO See *Holmium oxide*.
 IK See *Potassium iodide*.
 ILi See *Lithium iodide*.
 INa See *Sodium iodide*.
 $INaO$ See *Sodium iodate*.
 $IO.Tl$ Thallium iodate, 5085⁴.
 $IO.P$ Iodine phosphate, 1876⁴.
 ITI See *Thallium iodide*.
 $I.Mg$ See *Magnesium iodide*.
 $I.O$ See *Iodine oxide*.
 $I.Pb$ See *Lead iodide*.
 $I.Zn$ See *Zinc iodide*.
 $ILaO$ Lanthanum iodate, 5085⁴.
 INd See *Neodymium iodide*.
 $IO.Pt$ Praseodymium iodate, 4140¹.
 ISm See *Samarium iodide*.
 ITI See *Thallium iodides*.
 ISn See *Tin iodide*.
 ITI See *Titanium iodide*.
 $ITl.Zn$ Thallium zinc iodide, 2671⁴.
 $IndO$ See *Indium oxide*.
 IrO See *Iridium oxide*.
 $KLO.S$ Lithium potassium sulfate, 2863².
 KNO See *Potassium nitrate*.
 KNa , 4138¹.
 KOP See *Potassium metaphosphate*.
 $KO.Se$ Potassium perhenate, 4632².
 $K.MgO_3S + 4H_2O$ See *Leonite*.
 $K.MgO_3S$ See *Langbeinite*.
 $K.MnO$ See *Potassium manganate*.
 $K.MoO$ See *Potassium molybdate*.
 $K.MoSe$ Potassium selenomolybdate, 1586³.
 $K.MoSe$ Potassium perthiomolybdate, 4156⁷.
 $K.MoO_3$ Potassium molybdate, 4904¹.
 $K.NaO.Pt$ Potassium nitroplatinit, 1581¹.
 $K.O$ See *Potassium oxide*.
 $K.O.S$ See *Potassium sulfate*.
 $K.O.Se$ See *Potassium selenate*.

K₂O.W See *Potassium tungstate*.
K₂O.S₆ Potassium hexathionate, 4158².
K₂O.S₇ See *Potassium persulfate*.
K₂O.S₂.Ti + 3H₂O Potassium peroxotitanyl sulfate, 786².
K₂O.S₂.U + 2H₂O Potassium uranyl sulfate, 2659⁴.
K₂O.S₂.Zr + 3H₂O Potassium peroxozirconyl sulfate, 786².
K₂O₁₀.W₃ Potassium tungstate, 4904³.
K₂O₁₀.W₄ Potassium tungstate, 4904³.
K₂.S See *Potassium sulfide*.
K₂O.Ti + 6H₂O Potassium pertitanate, 786².
K₂O.Zr + 6H₂O Potassium perzirconate, 786².
K₄.S.V₂ Potassium perthiovanadate, 4156².

La.N.O₃ See *Lanthanum nitrate*.
La.O See *Lanthanum oxides*.
La₂O₃ See *Lanthanum oxides*.
Li.NO₃ See *Lithium nitrate*.
Li₂.Mo.O₄ See *Lithium molybdate*.
Li₂.Mo₂.O₇ See *Lithium molybdate*.
Li₂.Mo₂.O₁₀ See *Lithium molybdate*.
Li₂.Mo₂.Na₂.O₁₄ Lithium sodium molybdate, 4904¹.
Li₂.Mo₂.Na₂.O₁₈ Lithium sodium molybdate, 4904³.
Li₂.Mo₂.O₁₃ Lithium molybdate, 4904².
Li₂.Na₂.O₁₀.W₄ Lithium sodium tungstate, 4904³.
Li₂.O.S See *Lithium sulfate*.
Li₂.O.W See *Lithium tungstate*.
Li₂.O.W₂ See *Lithium tungstate*.
Li₂.O₁₀.W₄ See *Lithium tungstate*.

Mg.N₂.O₃ See *Magnesium nitrate*.
Mg.Na₂.O₃.S₂ (See also *Astrakanite*; *Bloedite*; *Löweite*.)
 + 2H₂O Magnesium sodium sulfate, 3149².
Mg.Na₂.O₃.S₄ (See also *Anthophyllite*.)
 Magnesium sodium sulfate, 3119⁴.

Mg.O See *Periclase*.
Mg.O.S₂ See *Magnesium thiosulfate*.
Mg.O₂.Sn See *Magnesium stannate*.
Mg.O.Ti Magnesium titanate, 1791⁴.
Mg.O.S See *Epsomite*; *Kieserite*; *Magnesium sulfate*.

Mg.O₂.Se See *Magnesium selenate*.
Mg.O.W See *Magnesium tungstate*.
Mg.S See *Magnesium sulfide*.

Mg.Se Magnesium selenide, 1329³.
Mg.Zn, 2684².
Mg.Zn₂, 4863¹.

Mg.Zn₂, 6198², 4863¹.
Mg.O.Si See *Forsterite*.
Mg.O.Sn Magnesium orthostannate, 4649¹.
Mg.Ni₂.O₄.S₂ Magnesium samarium nitrate, 4139¹.

Mg.O.P₂ See *Magnesium phosphates*.
Mg.P₂ Magnesium phosphide, 2862¹.
Mn.N₂.O₃ See *Manganese nitrate*.

Mn.Na₂.O₃.S₂ + 2H₂O, 1343², 4616².
Mn.O See *Manganese oxides*; *Manganosite*.
Mn.O₂ See *Manganese oxides*; *Potianite*.

Mn.O₂.Si See *Rhodanite*.
Mn.O.S See *Manganese sulfate*.
Mn.O.W See *Manganese tungstate*.

Mn.S See *Manganese sulfide*.
Mn.Te₂ Manganese telluride, 1790⁴.
Mn.O₂ See *Manganese oxides*; *Manganite*.

Mn.O₂.Si See *Tephroite*.
Mn.N₂ See *Manganese nitrides*.
Mn₂.O₃ See *Hausmannite*; *Manganese oxides*.

Mn₂.N₂ See *Manganese nitrides*.
Mn₂.N₂ See *Manganese nitrides*.
Mn₂.O₂.Si See *Braunite*.

Mo.Na₂.O₄ See *Sodium molybdate*.
Mo.O₂ See *Molybdenum oxide*.
Mo.O₂.Pb See *Lead molybdate*; *Wulfenite*.
Mo.O₂.Se, 788³.
Mo.S See *Molybdenum sulfide*.
Mo.S₂ See *Molybdenite*.
Mo.Se₂, 1586².
Mo.Na₂.O₇ Sodium molybdate, 4904².
Mo.O₂ See *Molybdenum oxides*.
Mo.O₂.Sn Tin molybdate, 4868³.
Mo.O₂.Th See *Thorium molybdate*.
Mo.S₂.Tl₂ Thallium perthiomolybdate, 4156².
Mo.Se₂, 1586².
Mo-Se₂, 1586².
Mo.Na₂.O₁₀ Sodium molybdate, 4904².
Mo.Na₂.O₁₃ Sodium molybdate, 4904².

NNa₂.O₂ See *Sodium nitrate*.
NNa₂.O₂ See *Sodium nitrate*.
NNa₂.O₂.S + H₂O See *Darapskite*.
NO See *Nitrogen oxides*.
NO₂ See *Nitrogen oxides*.
NO₃ See *Nitrogen oxides*.
NO₃.Rb See *Rubidium nitrate*.
NO₃.Tl See *Thallium nitrate*.
NSi See *Silicon nitride*.
NTi See *Titanium nitride*.
N.Ni₂.O₄ See *Nickel nitrate*.
N₂.O See *Nitrogen oxides*.
N₂.O₂ See *Nitrogen oxides*.
N₂.O₃ See *Nitrogen oxides*.
N₂.O₄ See *Nitrogen oxides*.
N₂.O.Pb See *Lead nitrate*.
N₂.O.Sr See *Strontium nitrate*.
N₂.O.U See *Uranyl nitrate*.
N₂.O.S₂ Nitrosylsulfuric anhydride, 2384².
N₂.U₃ Uranium nitride, 1343².
N₂.Zn₂ See *Zinc nitride*.
N₂.Na See *Sodium azide*.
N₂.O₂.Sm See *Samarium nitrate*.
N₂.O₂.Th See *Thorium nitrate*.
N₂.O₂.S₂, 2384².
N₂.S₂ Sulfur nitride, 3177².
N₂.U₃ Uranium nitride, 1343².
N.P₂ Phosphorus nitride, 3413⁴.
N.Pb See *Lead azide*.
Na.O₂.Re Sodium perhenate, 1833², 4632¹.
Na.Zn₂, 4157².
Na₂.NiO₂.P₂ + 12H₂O Nickel sodium hypophosphate, 1584².

Na₂.O See *Sodium oxides*.
Na₂.O₂ See *Sodium oxides*.
Na₂.O₂.Sn Sodium stannite, 4160⁴.
Na₂.O.Pb + 3H₂O Sodium plumbate, 2115².
Na₂.O.S₂ See *Sodium sulfites*.
Na₂.O.S₂ See *Sodium thiosulfate*.
Na₂.O.Sn See *Sodium stannate*.
Na₂.O.S See *Sodium sulfate*; *Thenardite*.
Na₂.O.S₂ See *Sodium hyposulfite*.
Na₂.O.W See *Sodium tungstate*.
Na₂.O.W₂ See *Sodium tungstate*.
Na₂.O.S₂.Zn + 4H₂O, 1343².
 Sodium zinc sulfate, 3149², 4616².
Na₂.O₂.W₂ Sodium tungstate, 4904².
Na₂.S See *Sodium sulfides*.
Na₂.Te See *Sodium telluride*.
Na₂.Te₂ See *Sodium telluride*.
Na₂.Te₃ See *Sodium telluride*.
Na₂.O.P See *Sodium hypophosphite*.
Na₂.O.P₂ See *Sodium phosphite*.
Na₂.O.P₂ See *Sodium phosphates*.
Na₂.O.P₂ Sodium hypophosphate, 1584².
Na₂.O.P₂ See *Sodium pyrophosphate*.
Na₂.O₂.Ti₂ See *Sodium silicotitanate*.

- Na₂O₂·S₂·Zn** Sodium zinc sulfate, 3149⁴.
Na₂O₂·W Sodium paratungstate, 3639¹.
NdO₂·B₂ Neodymium perberrhenate, 4632¹.
Nd₂O₃ See Neodymium oxide.
Nd₂O₃·S, 4139².
Nd₂O₃·S₂ See Neodymium sulfate.
NiO See Nickel oxides.
NiO·Si Nickel silicate, 2642².
NiO·S See Nickel sulfate.
NiO·S₂ See Nickel selenate.
NiO·W See Nickel tungstate.
NiS See Millerite; Nickel sulfide.
Ni₂O₃ See Nickel oxides.
Ni₂S₂ See Nickel sulfides.

OPb See Lead oxides; Lathargite.
OPd See Palladium oxide.
OS See Sulfur oxides.
OSn See Tin oxides.
OSr See Strontium oxides.
OZn See Zincite; Zinc oxide.
O₂Os See Osmium oxides.
O₂Pb See Lead oxides.
O₂Pr See Praseodymium oxides.
O₂Re See Rhenium oxides.
O₂Ru See Ruthenium oxides.
O₂S See Sulfur dioxide.
O₂Se See Selenium oxide.
O₂Si See Cristobalite, Quartz, Tridymite.
O₂Sn See Cassiterite, Tin oxides.
O₂Sr See Strontium oxide.
O₂Te See Tellurium oxide.
O₂Th See Thorium oxides.
O₂Ti See Brookite, Rutile, Titanium oxide.
O₂U See Bröggerite; Uranium oxide.
O₂Zr See Baddeleyite; Zirconium oxide.
O₂P See Phosphorus oxides.
O₂PbSi Lead silicate, 2642².
O₂Pr See Praseodymium oxide.
O₂Re See Rhenium oxides.
O₂Rh See Rhodium oxide.
O₂S See Sulfur trioxide.
O₂Si₂Sr Strontium thiosulfate, 3416¹.
O₂ Sb₂ See Antimony oxides.
O₂Sc See Scandium oxide.
O₂Sm See Samarium oxide.
O₂Si₂Zr Strontium zirconate, 1791⁵.
O₂Tb See Terbium oxide.
O₂Ti See Titanium oxides.
O₂Th See Thorium oxides.
O₂Tm See Thulium oxide.
O₂U See Berquerelite; Uranium oxides.
O₂V See Vanadium oxides.
O₂W See Tungsten oxides.
O₂Y See Yttrium oxide.
O₂Yb See Ytterbium oxides.
O₂Os See Osmium oxides.
O₂Pb₂ Antimony phosphate, 5126¹.
O₂Pb₂Sm See Samarium phosphate.
O₂Pb₂S See Anglesite.
O₂Pb₂SiZn See Larsenite.
O₂Pb₂ See Lead oxides.
O₂Ru See Ruthenium oxides.
O₂Si₂Sr See Strontium sulfate.
O₂STl See Thallium sulfate.
O₂Sn See Zinc sulfate.
O₂SiTh See Hydrothorite; Orangite, Th
O₂SiZn See Willemite.

O₂Th See Thorium oxide.
O₂U See Uranium oxides.
O₂U₂ + 7H₂O See Iankhinite.
O₂WZn See Zinc tungstate.
O₂P₂ See Phosphorus oxides.
O₂SV Vanadyl sulfate, 1583³.
O₂Ta₂ See Tantalum oxides.
O₂V₂ See Vanadium oxides.
O₂P₂ See Phosphorus oxides.
O₂Pb₂SiU See Kosolite.
O₂Pr₂S, 4140³.
O₂SSm₂, 4139³.
O₂SU See Uranyl sulfate.
O₂Si₂Sr Strontium tetrathionate, 4156¹.
O₂Re₂ See Rhenium oxides.
O₂Th₂ See Thorium oxides.
O₂P₂Si₂ See Strontium phosphate.
O₂P₂Th₂ Thorium hypophosphate, 2087⁰.
O₂Re₂ See Rhenium oxides.
O₂STh Thorium sulfate, 4869³.
O₂STl See Thallium sulfate.
O₂STz See Zirconium sulfate.
O₂SnW₂ Tin tungstate, 4868¹.
O₂U₂ See Uranium oxides.
O₁₀P₂Pb₂U + H₂O See Parsonite.
O₁₀STz₂ + 8H₂O Zirconium peroxosulfate, 786⁰.
O₁₁Si₃, 341².
O₁₁Pr₂S₂ See Praseodymium sulfate.
O₁₁Rh₂Si₂ See Rhodium sulfate.
O₁₁Si₂Sm₂ See Samarium sulfate.
O₁₁P₂Pb₂W₂ + 5H₂O See Dumontite.
O₁₁P₂Th₂ Thorium phosphate, 4868¹.
O₁₁PbW₂ + 10H₂O See Fourmarierite.
OsS₂ Osmium sulfide, 1790³.
OsSe₂ Osmium selenide, 3384⁶.
OsTe₂ Osmium telluride, 3384⁶.

P₂Pt Platinum phosphite, 5077³.
P₂S₂ See Phosphorus sulfides.
P₂Zn Zinc phosphide, 2862⁴.
PbS See Galena; Lead sulfide.
PbSe See Lead selenide.
PbTe See Allatite.
PbTl₂, 1559³.
PdTe Palladium telluride, 3384⁶.
PdTe₂ Palladium telluride, 3384⁶.
PtSb Platinum antimonide, 5077³.
PtSb₂ Platinum antimonide, 3384⁶.
PtSe₂ Platinum selenide, 3384⁶.
PtTe₂ Platinum telluride, 3384⁶.

ReS₂ See Rhenium sulfides.
ReS₃ See Rhenium sulfides.
ReS₄ See Rhenium sulfides.
RhS₂ Rhodium sulfide, 5077³.
RuS₂ Ruthenium sulfide, 1790³.
RuSe₂ Ruthenium selenide, 3384⁶.
RuTe₂ Ruthenium telluride, 3384⁶.

SSr See Strontium sulfide.
SZn See Sphalerite; Zinc sulfide.
S₂Sb₂ See Antimony sulfides; Stibnite.
S₂Tl₂V₂ Thallium perthiovanadate, 4156¹.
Sb₂Sn₂, 1544².
Sb₂Sn₂, 1544².
Se₂Sr Strontium selenide, 1329³.
Se₂Te₂ See Zinc selenide.
Se₂Te₂ Strontium telluride, 1329⁴.

